POPULAR SCIENCE

MONTHLY

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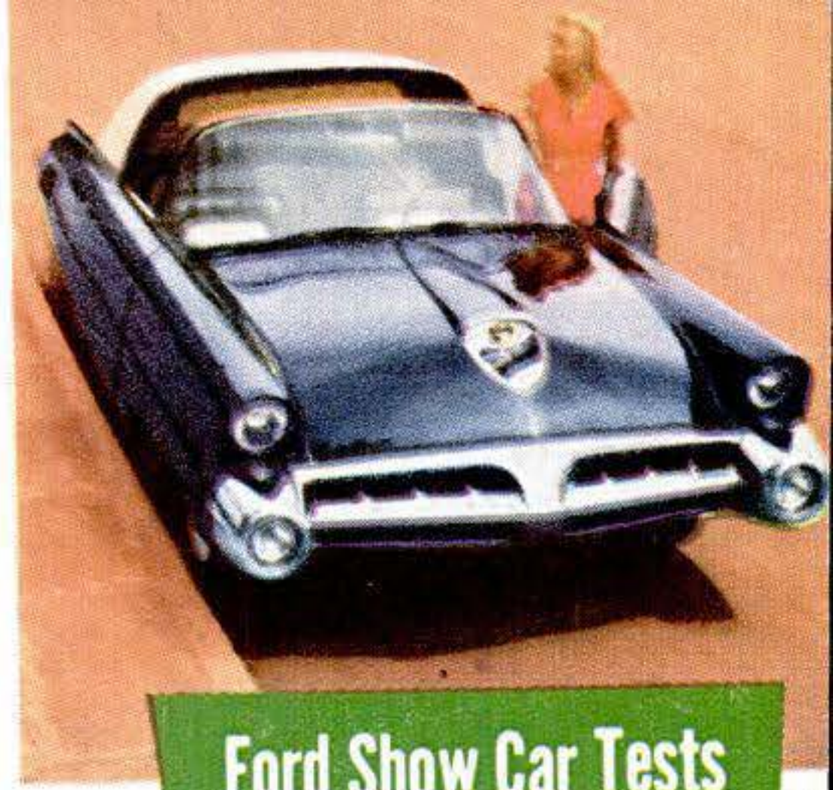

Ford Show Car Tests 50 Ideas - PAGE 122

25¢ October

All About 1954 Hudson

PAGE 168
California's Cure for Traffic

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PAGE 185

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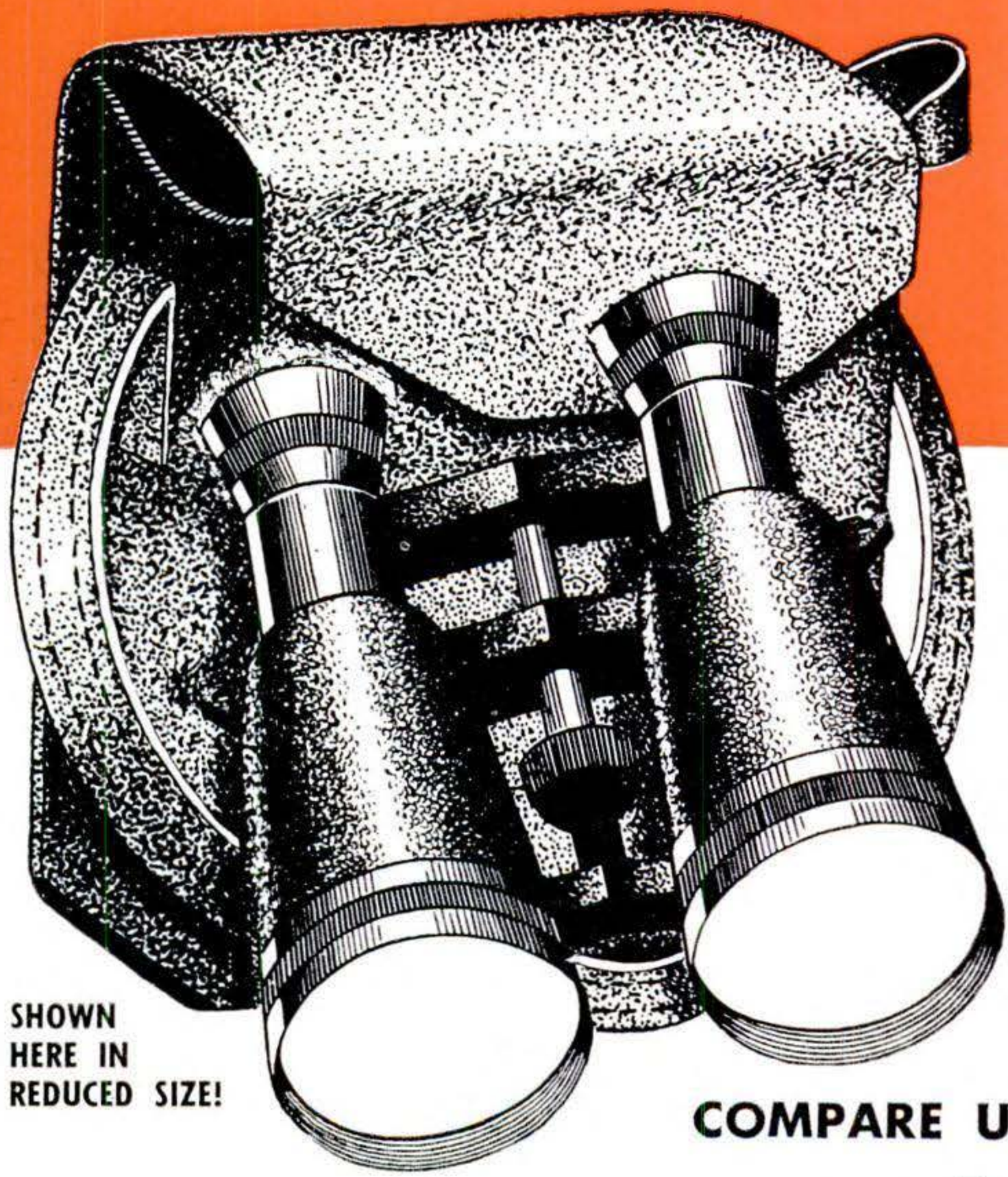
Special Announcement!

New Shipment of Famous Roth-Klaroptar Binoculars Has Arrived from Germany



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We're happy indeed to announce that a shipment of several thousand of these famous 3 X, 40 binoculars has arrived from Germany. Some time ago we got a shipment and were flooded with orders. We were sold out in practically no time! We were forced to hold up thousands of orders and disappointed a lot of nice folks. This time we're taking no chances! We are strictly limiting orders to ONE per family, and will sell NONE to dealers.

Rothlar Lenses Are Precision Made

The secret of ROTHLAR'S great public acceptance is the precision-made lenses. Unlike other glasses, they are not moulded or stamped out on plastic presses: They are ground out ONE BY ONE by proud German optical workers. This takes much more time and limits production. But what a difference! Viewing is sharp, clear, magic-like! No annoying distortions! No chromatic fringe to cause eyestrain! ALL Rothlar glasses are turned out under the supervision of WALTER ROTH, in his small factory in Hartmannshof, Western Germany. He has the Old World family pride. Herr Roth simply won't let an inferior product bear his name. Naturally, this means you get a really superior binocular if you are one of the lucky people to order this optical instrument.

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We'll send you a ROTHLAR for 5 DAYS' TRIAL. Enjoy it without obligation. Use it for sports, boxing matches, races, basketball, football. It's ideal for Nature study, motoring, sailing, airplane spotting, watching your neighbors, celestial observation and viewing distant scenery. Compare it at ANY distance from 18 feet to 18 miles. You must be delighted or your $3 comes back—no questions asked! We suggest you rush your $3 by return mail or come in person, if you can. These few thousands won't last long! First come, first served. Orders received too late will be returned promptly.

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Name.....

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☐ Check here if you want DELUXE MODEL instead, with built-in compass. Only $1 more—total $4.

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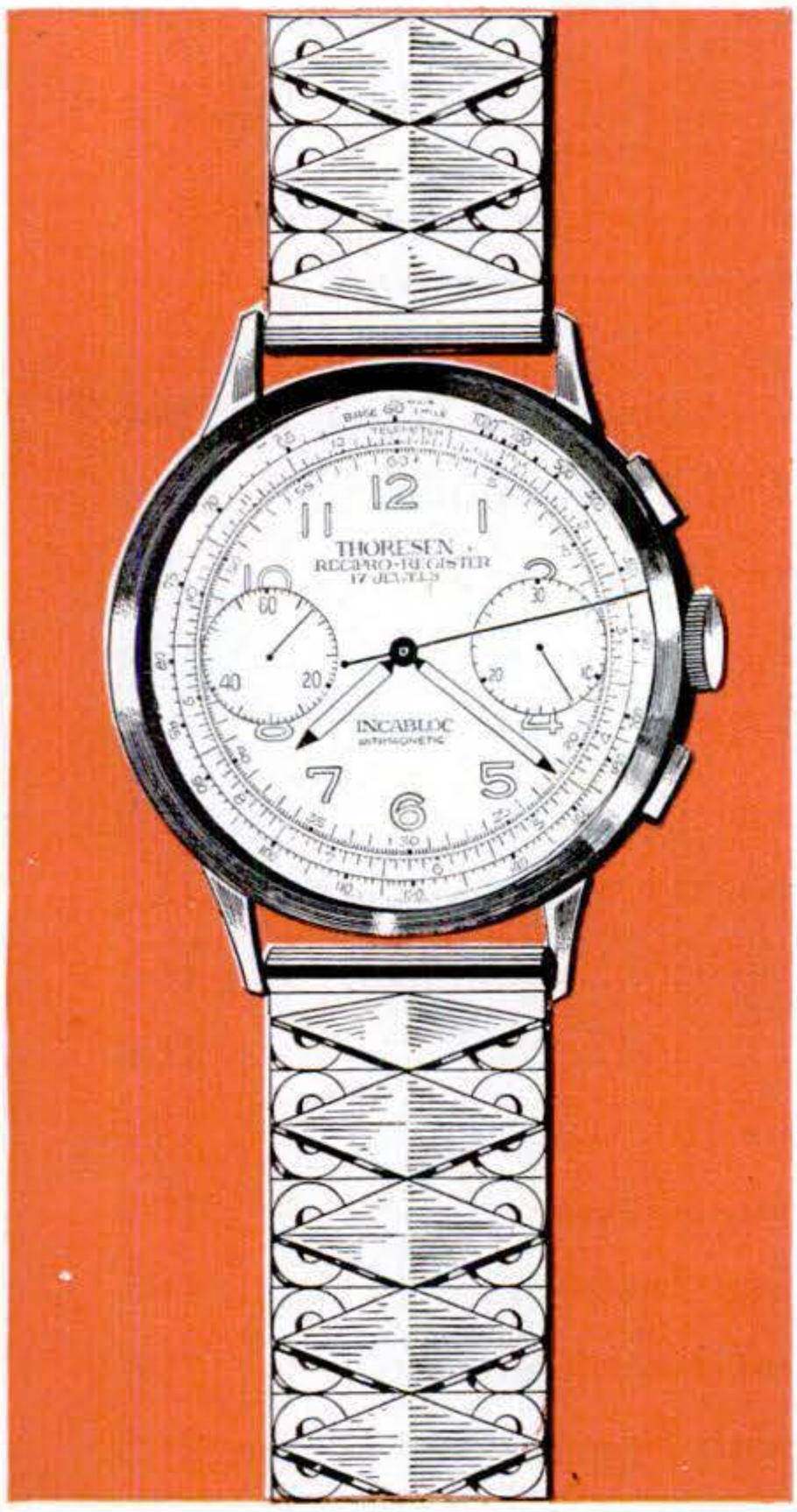
LATEST 1954 MODEL

Recipro Register

17 JEWEL CHRONOGRAPH



World Famous Watch of Amazing Accuracy

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Thoresen is first again with the latest! The all-new **RECIPRO-REGISTER CHRONOGRAPH** for **1954** is now available. 50 years of Schild know-how have gone into it. This veritable triumph of Swiss watch making is packed with superior features found in watches selling for $100.00 or more. The **Recipro-Register** is a unique timepiece of incredible accuracy! It automatically computes speeds and distances down to 1/5th second tolerances! The **Recipro-Register FREEZES** the result indefinitely. It "remembers" for you while the movement keeps going. Compare it with other stop-chronographs and you will never be satisfied with anything less than this truly precision timepiece!

OVER 25 FEATURES FOR 1954

- **17 Full Jewels**
- **It "remembers"**
- **1/5th Second Calibrations**
- **30 Minute Register**
- **Anti-magnetic**
- **5 Dial Arrangement**
- **Beryllium Balance**
- **2 Independent Movements**
- **Super-Thin Case**
- **Stainless Steel Back**
- **Sweep Second Hand**
- **Built-in Telemeter**
- **Nivarox Spring that lasts**
- **Dual clutch operation**

• INCABLOC SHOCK ABSORBER WITH 2 JEWELS

The 5 multi function dials are automatically coupled and synchronized for hours, minutes, seconds and 1/5 seconds! Contact clutch starts computation. Brake clutch erases back to zero. Genuine radium-active light-absorbing numerals and hands glow in the dark. The case is sturdy but unusually **THIN**—giving this 1954 model that new tomorrow look. The new **DUAL JEWEL** Incabloc Shock absorber gives it longer life, sparkling performance, greater protection! This Schild masterpiece has won acceptance in over 38 countries because of its precision engineering, meticulous workmanship and quality materials.

DIRECT-FROM-SWITZERLAND LOW PRICE!

Recipro-Registers are flown in direct from Switzerland to us. No dealers or jobbers profits added. You pay the **SAME** price as if you were in Switzerland itself! **NOW** . . . direct to you for only **29.95**, tax paid. Save postage by remitting check or money order for **QUICK** delivery. Or order COD plus postage. Instructions Brochure, Service Certificate and handsome gift box included. A handsome Flexible Metal Band given with each watch at no extra cost.

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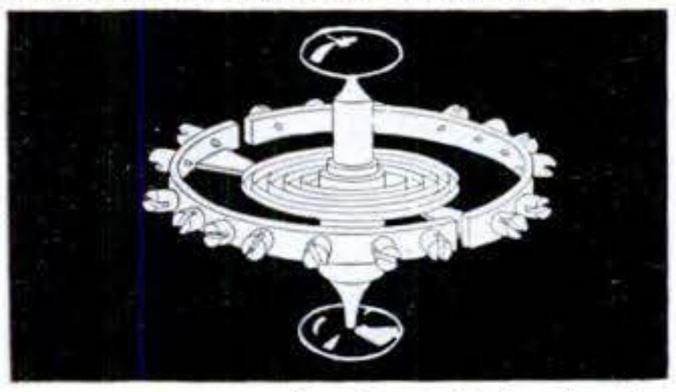
We should like to have you examine a **1954 Recipro-Register** for 5 days without obligation. You must be delighted with its rich, ultra-modern look. Check it for accuracy against U.S. Naval Observatory radio signals. Try its many timing and measuring functions. Then have it appraised by your trusted jeweler! If you find anything to compare with it under $100.00—or if you are not thrilled with this **NEW**, fun way to tell time, return for a full refund! Rush order **NOW**—don't wait for Christmas rush. This ad will not be repeated this year. Better clip coupon and mail today.

2 Jewel Incabloc Shock Absorber

protects, improves performance



This unique and patented shock absorber has taken the watch industry by storm! Its **TWIN JEWEL** pivots and **SEALED OIL CHAMBER** give the greatest possible shock-protection for the heart of your chronograph, the delicate balance assembly. Works like a willow in a windstorm—**GIVES** under pressure, then **SNAPS BACK** instantly! It protects the life of your new **1954 Recipro-Register**—insuring its accuracy!

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OCTOBER, 1953

A Geologist Reviews Facts About Dowsing

Howard A. Meyerhoff — who wrote this month's lead article, "Can a Water Witch Really Find Water?"—is a distinguished geologist who has spent much of his career looking for oil and water. Formerly secretary of the American Association for the Advancement of Science, he is now president of the Scientific Manpower Commission. His scientific view of dowsing begins on page 99.

Riding the Earth's Mightiest Tail Wind.....110
Thinking Machine Will Speed Mail.....114
Ford Displays 50 New Ideas.....122
Is Grand Canyon's Rival Deeper?.....126
Precut Lumber Simplifies Home Building....134
Pin Money from Parakeets.....140
They're Wearing Out '54 Cars Already.....152
Funniest Model T Stories.....163
Subways in the Sky.....168
Hudson Moves Up in Horsepower Race.....172
My Car Plows Its Own Driveway.....179
Fireplaces Anyone Can Install.....185
Gus and the Job That Backfired.....196
What You Can Do with Spark-Plug Tester..202
A Gun Rack You Can Lock.....205
Hardboards: Substitute for Wood.....208
How to Make a Metal-Cutting Bandsaw.....223
Will Your Mower Start Next Spring?.....229

(More features and departments are listed on page 6.)

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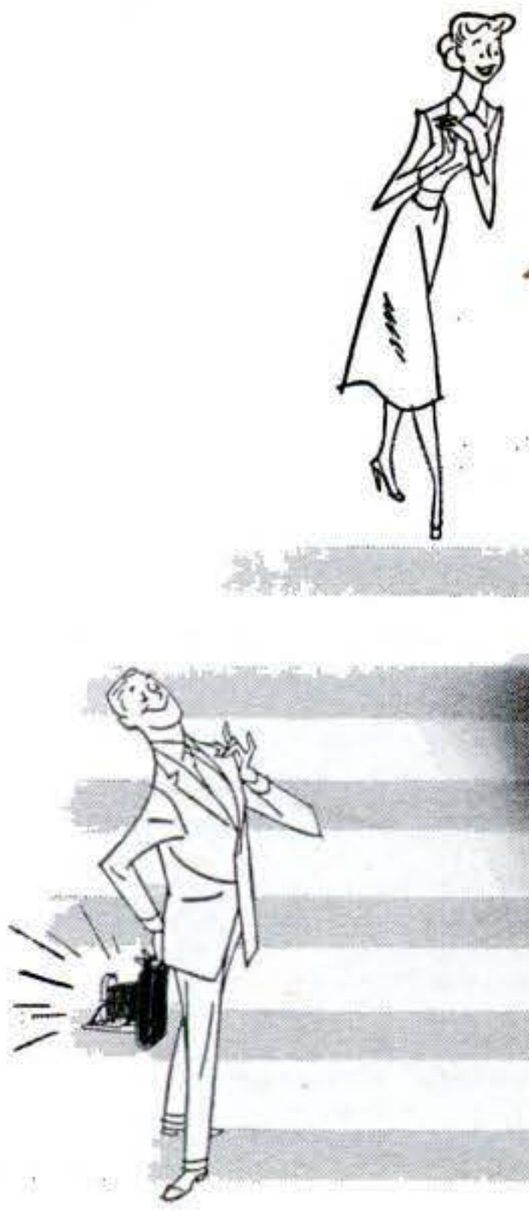

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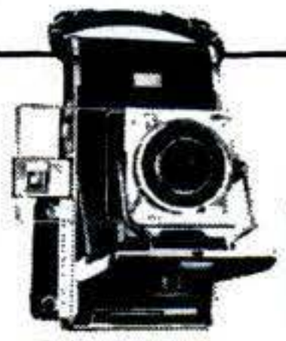
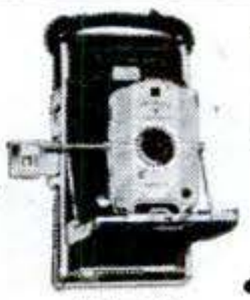


Polaroid Pathfinder Model 110



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- ☐ Traffic Management

CHEMISTRY
- ☐ Chemical Engineering
- ☐ Chemistry
- ☐ Analytical Chemistry
- ☐ Petroleum—Nat'l Gas
- ☐ Pulp and Paper Making
- ☐ Plastics

CIVIL, STRUCTURAL ENGINEERING
- ☐ Civil Engineering
- ☐ Structural Engineering
- ☐ Surveying and Mapping
- ☐ Structural Drafting
- ☐ Highway Engineering
- ☐ Reading Blueprints
- ☐ Concrete Construction
- ☐ Sanitary Engineering

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Mine Surveying and Drafting

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Electrician
- ☐ Electrical Maintenance
- ☐ Electrical Drafting
- ☐ Electric Power and Light
- ☐ Lineman

HIGH SCHOOL
- ☐ High School Subjects
- ☐ College Preparatory
- ☐ Mathematics
- ☐ Commercial
- ☐ Good English

MECHANICAL AND SHOP
- ☐ Mechanical Engineering
- ☐ Industrial Engineering
- ☐ Industrial Supervision
- ☐ Foremanship
- ☐ Mechanical Drafting
- ☐ Machine Design-Drafting
- ☐ Machine Shop Practice
- ☐ Tool Design
- ☐ Industrial Instrumentation
- ☐ Machine Shop Inspection
- ☐ Reading Blueprints
- ☐ Toolmaking
- ☐ Gas—Electric Welding
- ☐ Heat Treatment—Metallurgy
- ☐ Sheet Metal Work
- ☐ Sheet Metal Pattern Drafting
- ☐ Refrigeration

POWER
- ☐ Combustion Engineering
- ☐ Diesel—Electric
- ☐ Electric Light and Power
- ☐ Stationary Steam Engineering
- ☐ Stationary Fireman

RADIO, TELEVISION, COMMUNICATIONS
- ☐ General Radio
- ☐ Radio Operation
- ☐ Radio Servicing—FM
- ☐ Television
- ☐ Electronics
- ☐ Telephone Work

RAILROAD
- ☐ Locomotive Engineer
- ☐ Diesel Locomotive
- ☐ Air Brakes ☐ Car Inspector
- ☐ Railroad Administration

TEXTILE
- ☐ Textile Engineering
- ☐ Cotton Manufacture
- ☐ Rayon Manufacture
- ☐ Woolen Manufacture
- ☐ Loom Fixing
- ☐ Finishing and Dyeing
- ☐ Textile Designing

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News and Pictures

World's Greatest Speedboat....104
Skyscraper Gets Aluminum Skin....108
What Gun Are You Shooting?....118
New Blow-Up Boat Can Take It....120
"A-Bombs" Do Tricks for Atom Tamers..144
He Found a Fortune in a School Desk....148
Queen's New Yacht Can Be a Hospital..150
Swedes Hide Punch Under Mountains..157
Prefab Steeple Takes a Ride....162

Mechanics and Homebuilding

News from Auto Row....184
Trouble Shooting Your Lighter....190
Let Magnets Lend a Hand....191
Wordless Workshop....192
Scooter Shifts Down on Hills....201
Model Steam Plant Is One-Evening Job..212
Roll 'em, Store 'em, Smoke 'em....214
One-Evening Shop Projects....216
Homemade Tester for Appliances....218
How to See a Ghost....232
Californian Does Antique Photography..236
Wires Joined Without Solder....238
Off-Scale But On-Key Bookcase....244
What You Can Do with Steel Drums....248

Departments

Letters....18
New Ideas from the Inventors....131
I'd Like to See Them Make....147
P.S. Last Minute News and Notes....178
New Tools....195
Hints from the Model Garage....199
New for the Handy Man....221
Keeping the Home Shipshape....227
New Shop Ideas....245

NEXT MONTH:

Easy Way to Build Modern Furniture

Wrought-iron legs, now on the market in a variety of shapes and sizes, make any amateur an expert furniture builder. An article with how-to-do-it photos in POPULAR SCIENCE MONTHLY for November will tell how one beginner used them to build five handsome modern pieces for a cost of $84.19.

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NOW...Start Fixing TV and Radio Sets RIGHT AWAY

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McGraw-Hill's Amazing New Low-Cost Course Skips Confusing "Theories" and "Formulas," Tells "How-to-do-it" in PLAIN ENGLISH!

WHY hasn't somebody done this BEFORE?" That's what you'll exclaim the minute you start browsing through this amazing new one-volume course in radio and TV repair.

For here at last a well-known EXPERT has found a way to tell you in PLAIN ENGLISH how to fix almost ANY radio or television set. (And he even tells you where you can go to have the extra-tough jobs done FOR you . . . at reduced professional rates.) Right from the very first chapters you can start doing simple repairs . . . and before you're HALF way through the course, you can fix HALF the television and radio sets that you encounter. In just a few weeks you can tackle your own and friends' sets . . . get a service shop job . . . even start your own money-making business right in your own home.

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The author is Associate Editor of *Electronics* Magazine. He's a long-recognized expert—not only on radio and TV—but also on making technical subjects easily understood by the average reader. He has spent FOUR years making this one-volume course so practical and easy-to-understand that even an "un-handy" man who never fixed a door bell before will find the going easy.

Here's everything you need to know about *where* and *how* to buy tubes and parts, where and how to get an official circuit diagram for any receiver; how to choose and use basic tools; how to test tubes WITHOUT a tube tester; how to use 58 common TV controls; how to "diagnose" and "cure" common radio and TV troubles; how to fix loudspeakers, phono pickups; how to install and check antennas; and much, much more.

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Save $50 to $100 a year just in installing, repairing, and servicing your own TV set. Book tells which controls to adjust or tubes to replace if picture is entirely dark—blurred—split—distorted—off center—tilted—wiggles and weaves—too pale—too black—jitters—snow effects—drifts—etc., etc.

SEND NO MONEY

Examine this book for 10 days BEFORE you decide if you wish to own it. Try it out FREE on your own or a neighbor's set. See what a "breeze" it makes nearly every repair job. Make it *pay for itself in 10 days* or don't keep it! Mail coupon to:
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How to Remove and Replace Tubes • Testing Tubes without a Tester • Using a Tube Tester • Power-Supply Troubles • How to Test and Replace Resistors, Controls, Switches, Condensers, Coils, Transformers • Loudspeakers • Phono Pickups and Needles • Antennas . . . MUCH MORE

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Book Tells Where to Look for Bad Tube IF:

- No picture; no raster*; no sound.
- No picture; raster OK; no sound.
- No picture; no raster; sound OK.
- No picture; raster OK; sound OK.
- Picture jittery, double image; raster OK; sound OK.
- Snow on all channels; raster OK; sound weak.
- Snow on all channels; raster OK; sound OK.
- Picture and raster do not fill screen; sound OK.
- Picture drifts up or down but not sideways; raster OK; sound OK.
- Picture muddy and gray; raster OK; sound OK.

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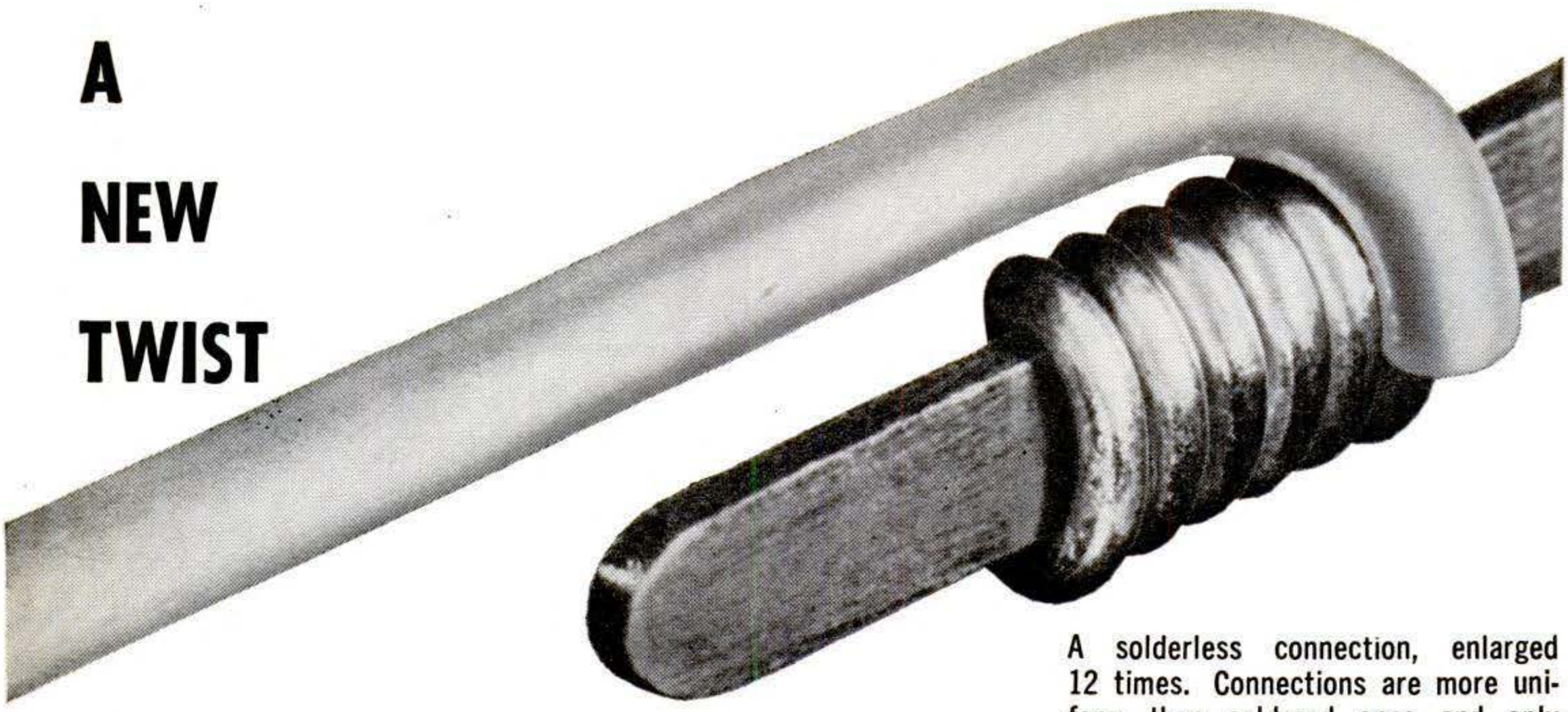
A NEW TWIST IN TELEPHONY



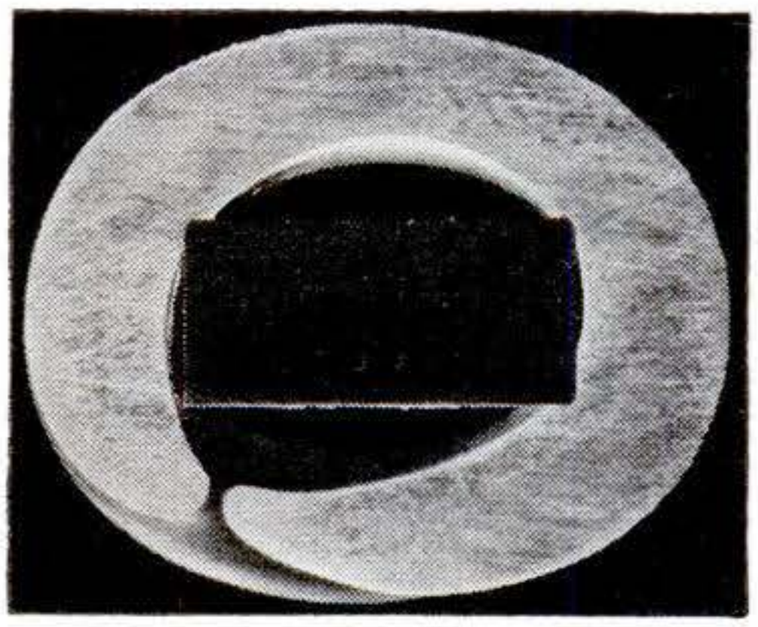
A solderless connection, enlarged 12 times. Connections are more uniform than soldered ones and only half as bulky.

For years the accepted way to connect wires to telephone apparatus was with solder. Now, Bell Laboratories engineers have discovered how to make connections faster and better—without solder.

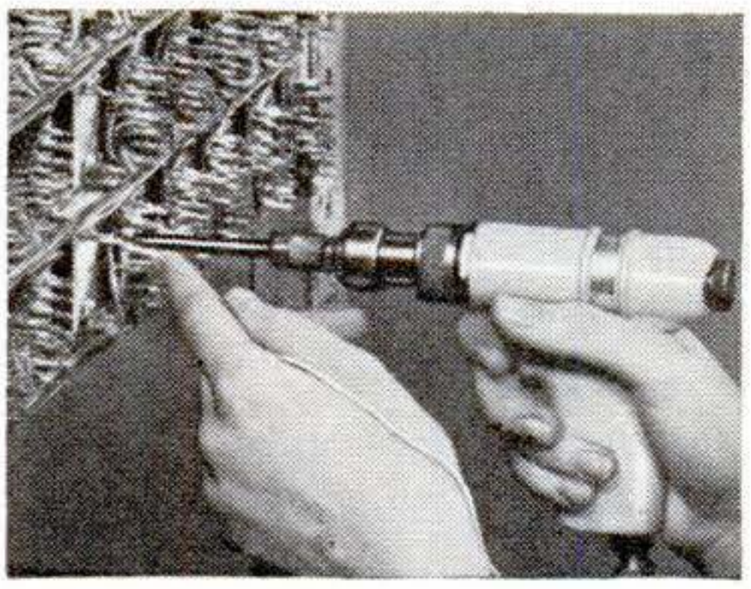
Solder, they reasoned, wouldn't be needed if wire and terminal could be kept tightly pressed together. But, for economy, this had to be done with the wire alone—without complicating screws and springs.

They found the answer in using a properly dimensioned terminal with sharp edges . . . whipping the wire around it under high tension. The terminal bites into the wire, locking it securely into position. Thereafter the squeezed edges maintain a contact pressure of at least 15,000 pounds per square inch—even under vibration that cracks soldered joints.

The new connections can be made in half the time—a big money-saver in the billion connections that Western Electric makes each year for the Bell System. It's another example of the way Bell Telephone Laboratories works continually to keep costs low.



Cross section of solderless connection. Note terminal biting into wire. In a six-turn connection there are at least 20 clean contact areas impervious to moisture and corrosive gases, and offering a low resistance path for current.



Power tool whips wire on terminal in fraction of a second. There is no heat which could damage miniature components . . . no dropped solder or wire clippings to cause trouble later on.

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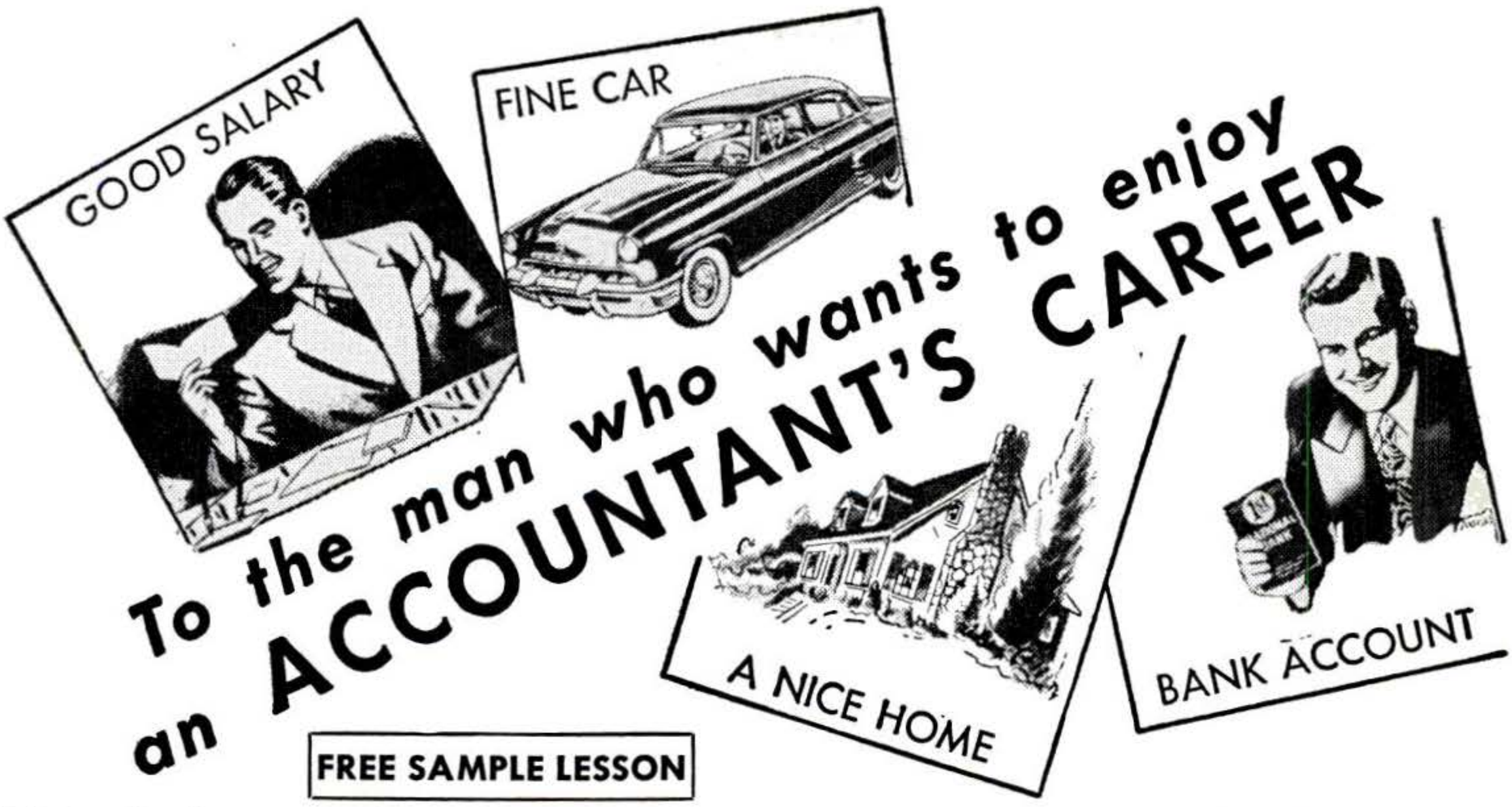

To the man who wants to enjoy an ACCOUNTANT'S CAREER

FREE SAMPLE LESSON

IF you're that man, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—a salary of $4,000 to $10,000?

An accountant's duties are interesting, varied and of real worth to his employers. He has *standing!*

Do you feel that such things aren't for you? Well, don't be too sure. Very possibly they *can* be!

Why not, like so many before you, investigate LaSalle's modern Problem Method of training for an accountancy position?

Just suppose you were permitted to work in a large accounting house under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then more difficult ones. If you could do this—and could turn to him for advice as the problems became complex — soon you'd master them all.

That's the training you follow in principle under the LaSalle Problem Method.

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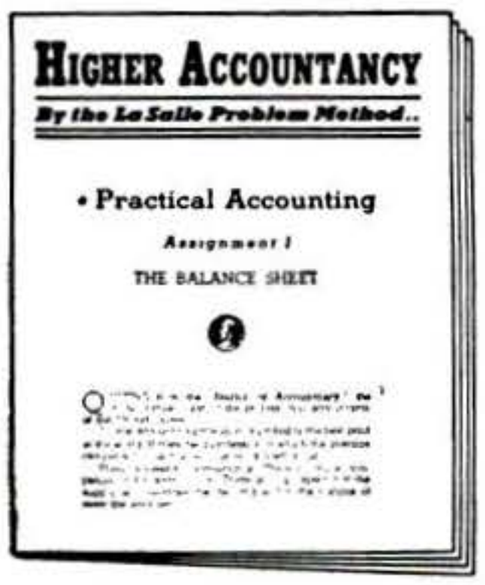

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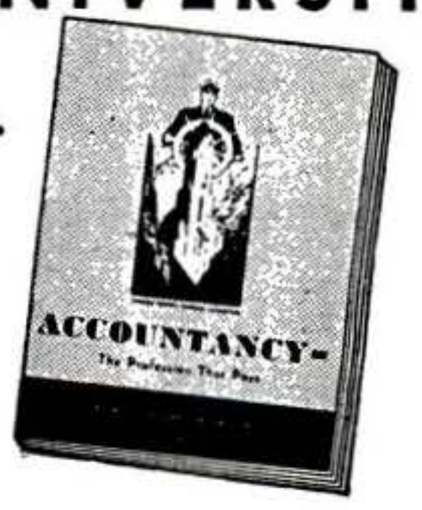

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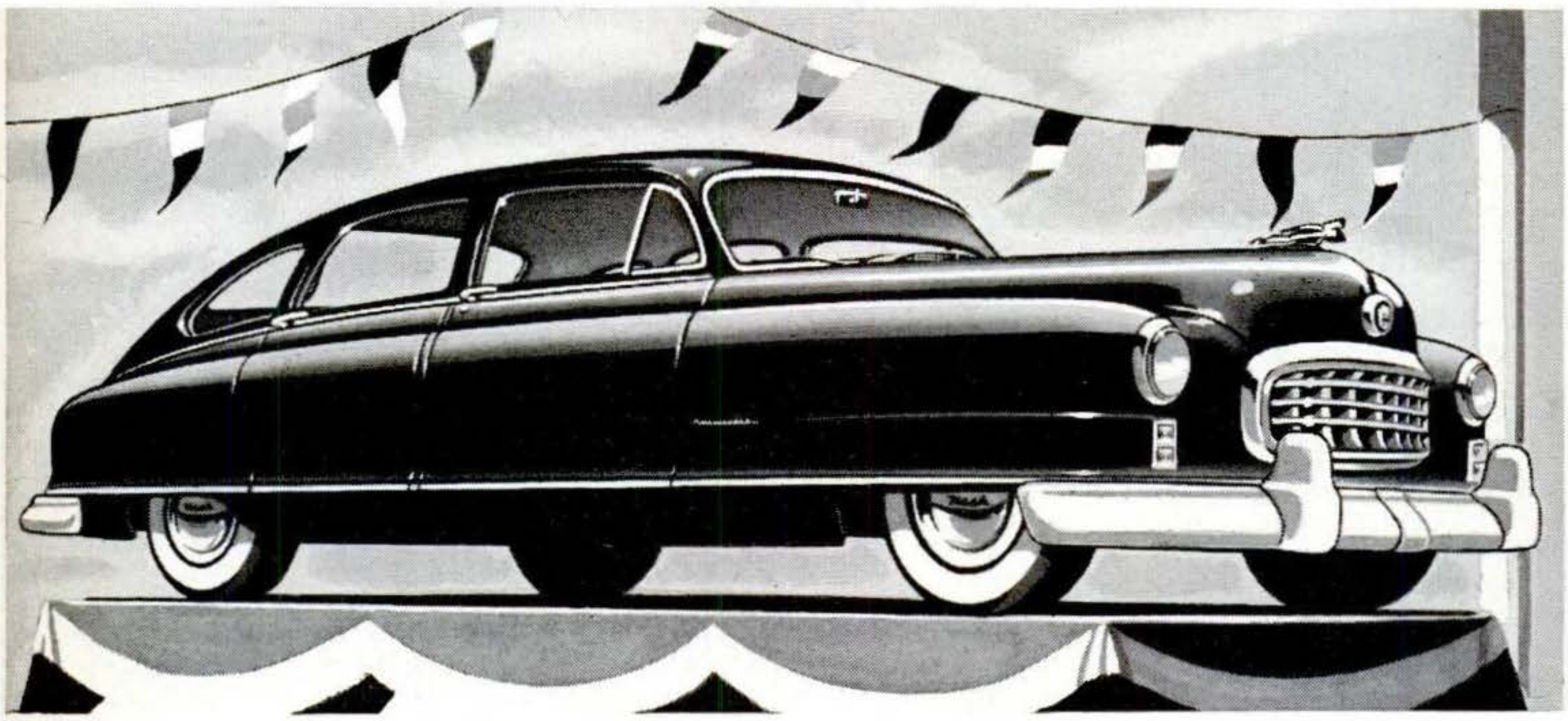
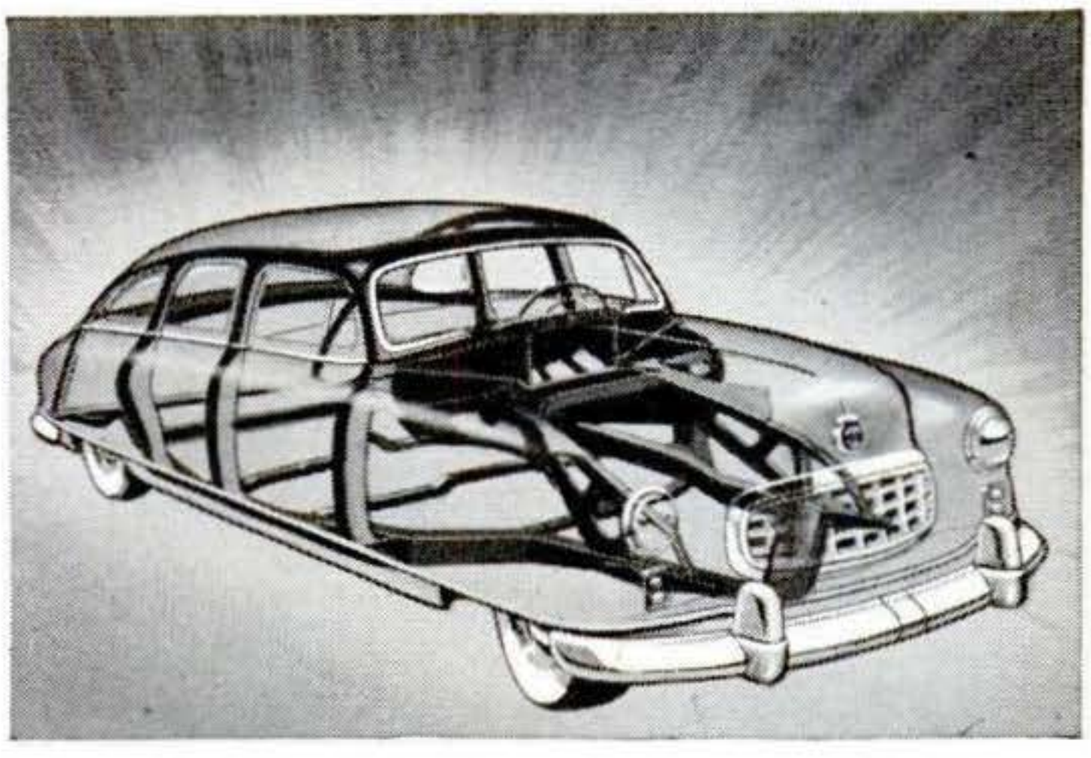
Now! A "Double-Lifetime" Used Car

that can save you hundreds of dollars!



Yes, today there's a new used-car value—a car built with a "Double-Lifetime" to last years longer so it's like new even as a used car . . . costs you less to own and drive. That car is Nash!

When you buy a used Nash you get a car that is more economical—more fun to drive, *newer*-looking, *newer*-feeling—a *newer* car for your money.



Nash is America's safest car with body and frame welded into a single, rock-solid unit that can never loosen, rattle or squeak. Huge steel girders surround the passenger compartment, protecting you and yours.

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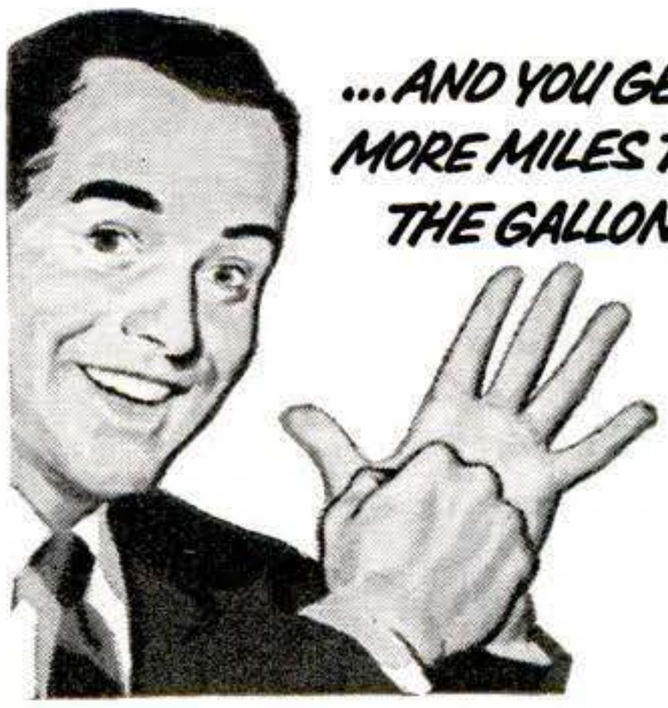
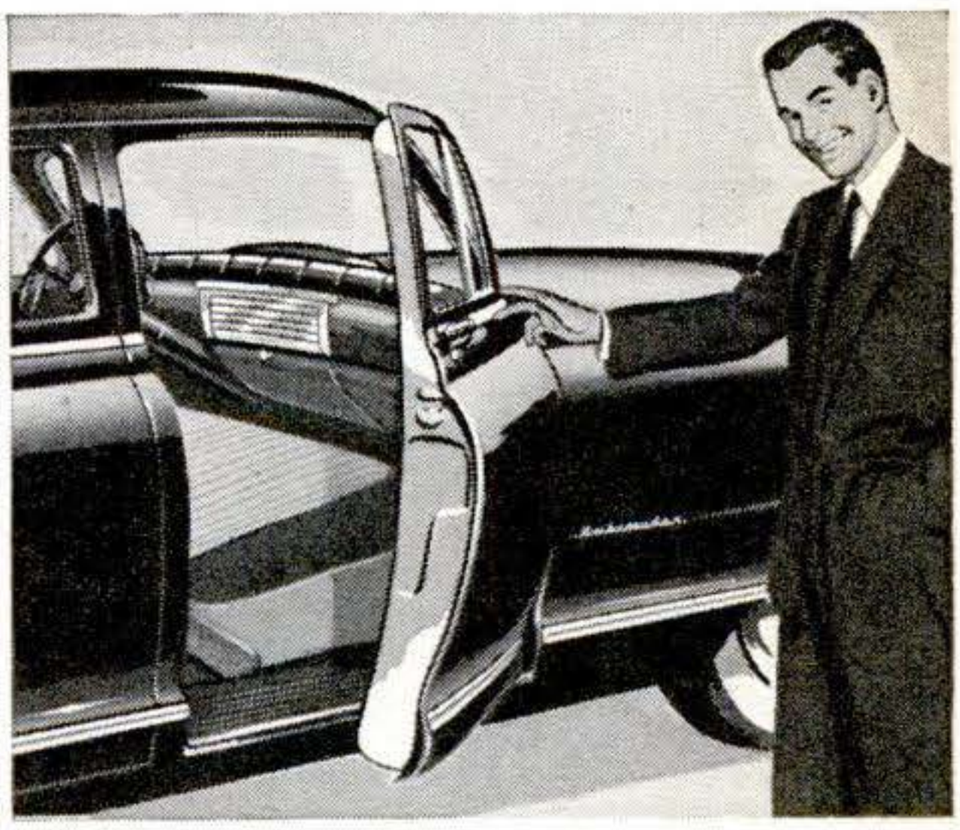
Nash beauty *lasts!* (1) Metal is Bonderized (2) for rustproofing, two coats of (3) primer sealer are baked 90 minutes. Two coats of (4) enamel are baked on to sparkle "like new" years longer.

Smoothest ride on the road with coil springs and stronger, rattle-free Airflyte Construction. Ample road clearance, too, for those spots in the woods. Drive a postwar Nash for more fun at less cost.



Nash Owners report more miles a gallon than owners of other make cars. Amazing gasoline savings are only one of the many economies you enjoy in Nash. Save on body upkeep and repair bills!

For real driving pleasure there's nothing like a Nash, with features that double the family fun—like famous Twin Beds that make up in seconds. With one bed made up, children can nap on trips.



Proof of a used car's condition is the way the doors fit. Because Nash is twice as rigid, doors fit without sagging—proof it's safer, stronger and longer-lasting—the car with a "double-lifetime."

Airliner Reclining Seat—only in Nash—adjusts to comfortable, relaxing positions. And only Nash offers you Weather Eye—world's finest heating and ventilating system.

Nash

The Car with the Double Lifetime
...Built to *Stay New* Longer

Nash Motors, Division Nash-Kelvinator Corp., Detroit, Mich.

See a Nash Dealer ***For the Best Used Car Buy in Town***

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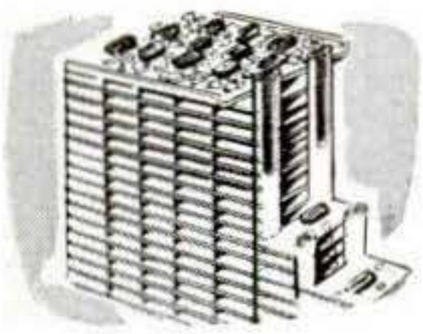
Don't put in a drop of anti-freeze...

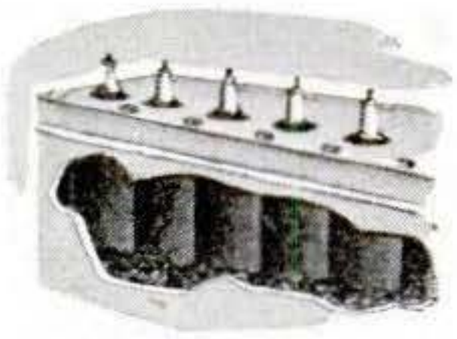
UNTIL YOU'VE CLEANED OUT RUST WITH

DU PONT *Cooling System* CLEANSER

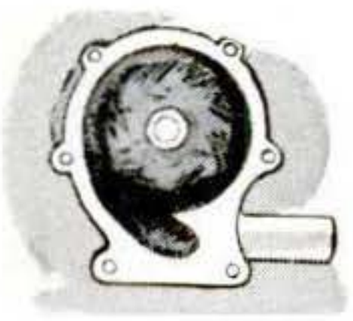
HOW RUST AND ACID CORROSION WASTE ANTI-FREEZE . . . CAUSE TROUBLE AND EXPENSE



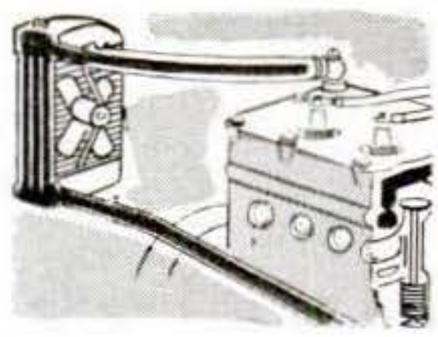
Accumulated rust, scale and corrosion plug radiator passages. This slows down circulation, may cause leaks. Anti-freeze may leak out . . . or "boil out" as motor overheats.



Acid corrosion and rust take place in engine block, too. Circulation slows down, proper cooling becomes impossible. Motor overheats and causes "boiling out" or creeping of anti-freeze.



Water-pump impeller blade is often attacked and eaten away by rust and corrosion. This causes failure of circulation in cooling system and dangerous overheating.



The heater is also part of your car's cooling system. Rust, scale and acid corrosion can impair its operation by clogging passages or destroying vital parts such as tubes.

Before you put in anti-freeze, your car's cooling system needs a careful check-up.

Clean out rust and scale—safely, easily, thoroughly — with Du Pont Cooling System Cleanser.

Simply pour Du Pont cleanser in the radiator and run the motor. It works even while you're driving . . . dissolves rust so it can be drained out. No reverse flushing necessary. Neutralizer is included in each can to complete the job. Insist on the original and genuine Du Pont Cleanser, marketed only by Du Pont in a package bearing the red Du Pont oval trade mark.

Ask about the complete Du Pont pre-anti-freeze service at your service station today and assure trouble-free driving this winter. Or get a can of Du Pont Cooling System Cleanser at your auto supply store . . . $1.25 at most dealers.

Insure against leaks that waste anti-freeze with DU PONT Cooling System SEALER

Even though your cooling system seems watertight, many permanent anti-freezes will "creep" through tiny pinholes. You can stop this seepage immediately with Du Pont Cooling System Sealer. Simply pour it into your radiator. It can't clog or harm hose or metal parts.

Don't forget fuel line anti-freeze—Du Pont Gas Guard.

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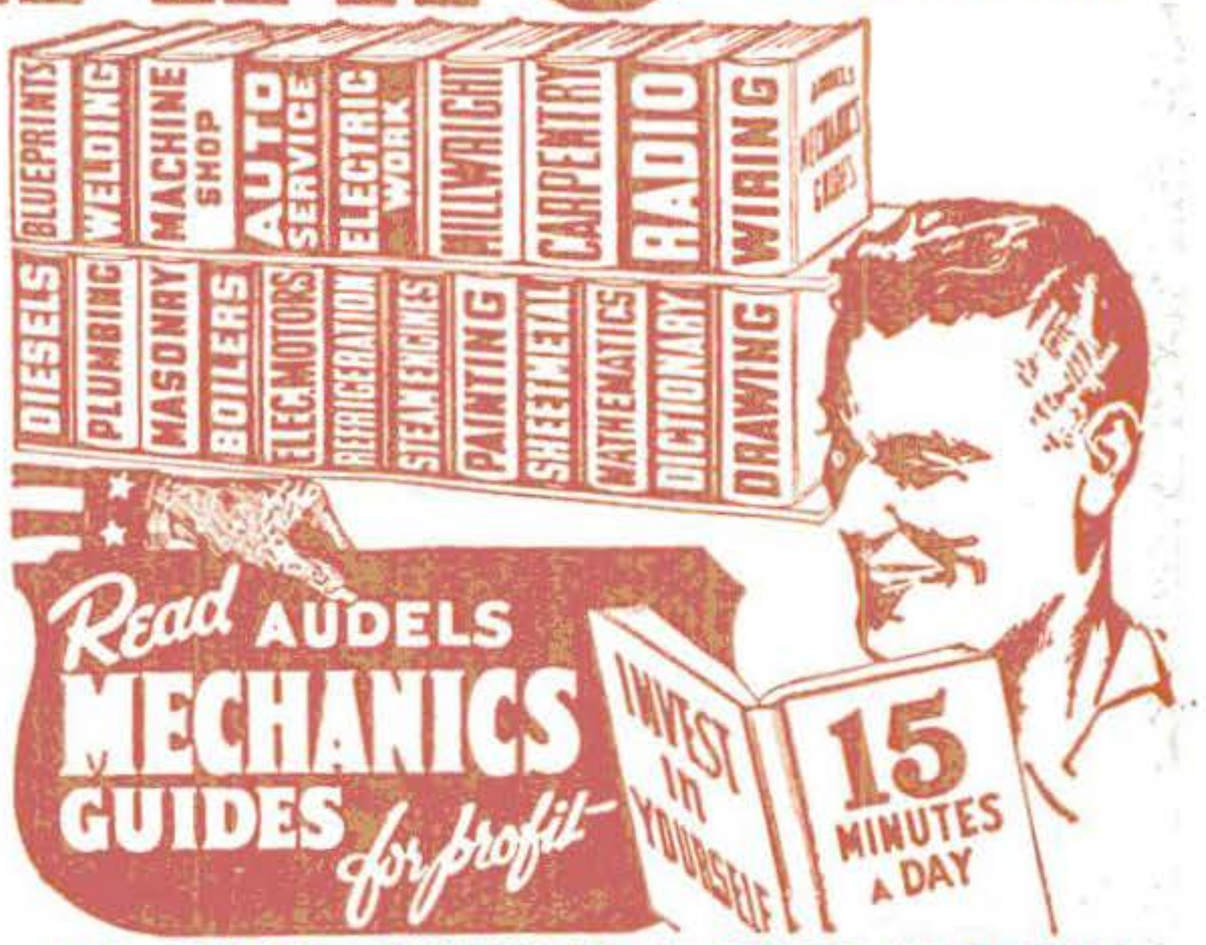

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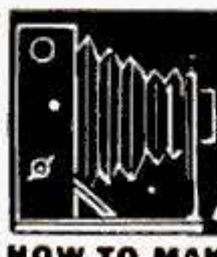

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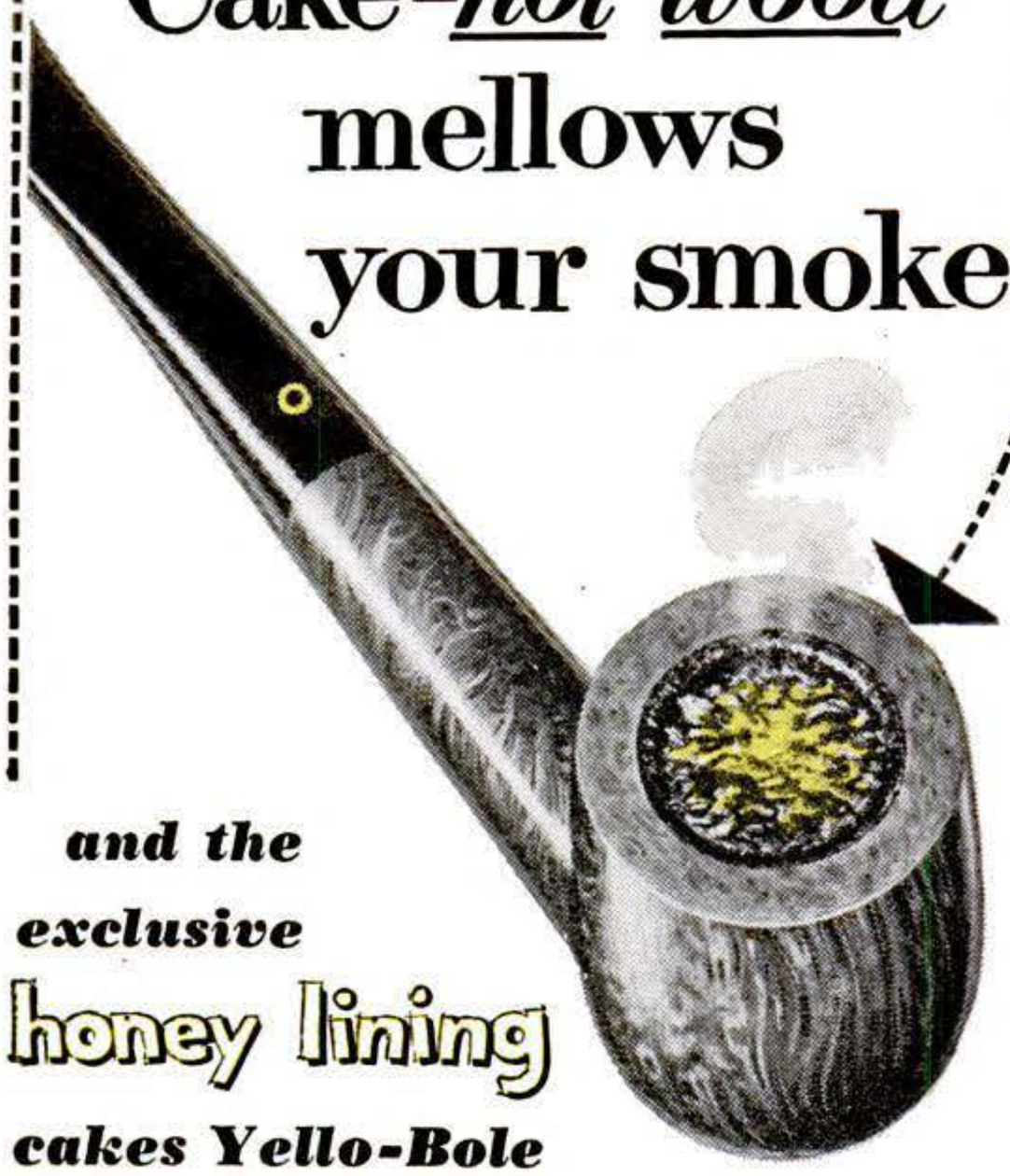

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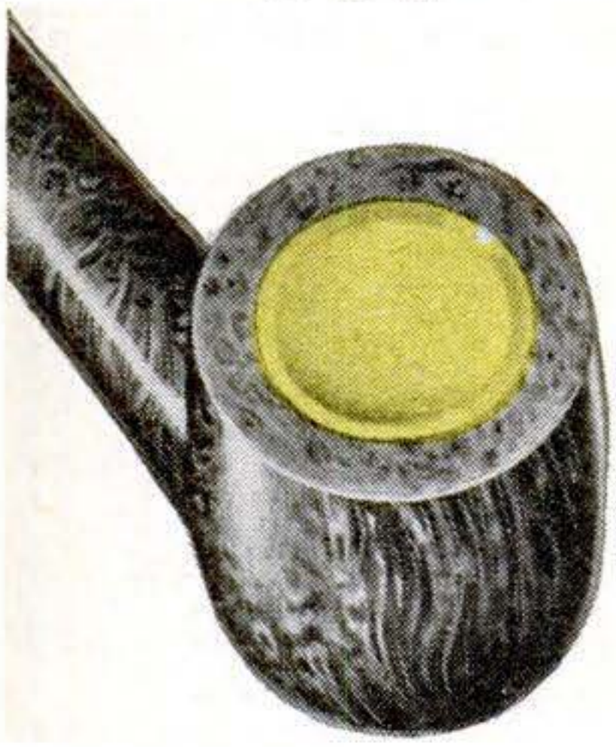

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Governors Favor Courteous Cops

I found the article "Courteous Cops Cut Crashes" [July, p. 62] most interesting and am recommending that the Superintendent of our state forces ask that his personnel read the article.

CHARLES H. RUSSELL, Governor
State of Nevada.

I enjoyed the article and want to compliment the State of New Jersey on their program of promoting highway safety. We are making an earnest effort here in Indiana to coordinate all facilities to insure that our highways are safer and we appreciate knowing what is being done elsewhere.

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I am calling the article "Courteous Cops

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Cut Crashes" to the attention of our Utah Highway Patrol.

J. BRACKEN LEE, Governor
State of Utah.

Several Governors have written to me that they are referring it to their appropriate departments and agencies for careful reading. I feel that you have made a contribution to highway safety.

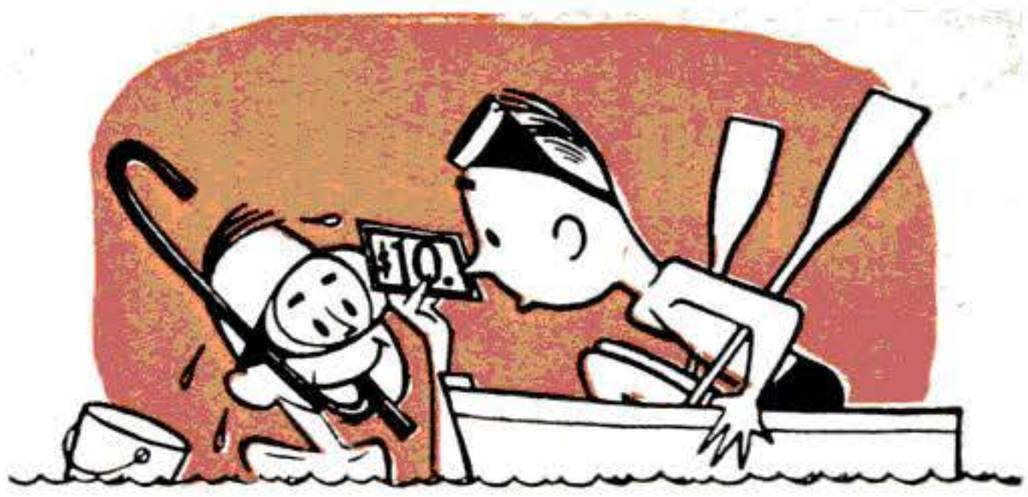
ALFRED E. DRISCOLL, Governor
State of New Jersey.

Copies of the article, "Courteous Cops Cut Crashes," about the policing of the New Jersey Turnpike, were sent to all 48 Governors with the compliments of Governor Driscoll of New Jersey.

California Vs. Florida

The article about "What You Can Do with a Snorkel" in your July issue mentioned someone's finding a dollar bill at the bottom of the Atlantic Ocean off Key West, Fla.

Well, last year while I was trying out my new snorkel at Catalina Island, I happened to see an old bucket about 25 feet



down. And on pulling it up—I found a *ten*-dollar bill.

CARL IVERSON, Los Angeles.

Australian Road Train

I have often read descriptions in POPULAR SCIENCE and other American magazines of your huge highway transports.

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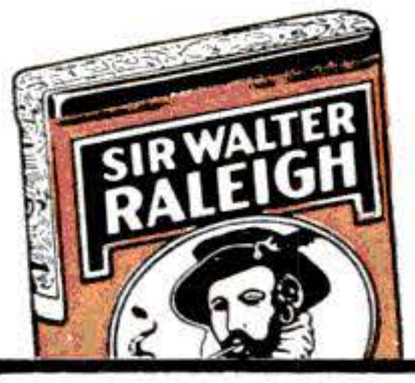

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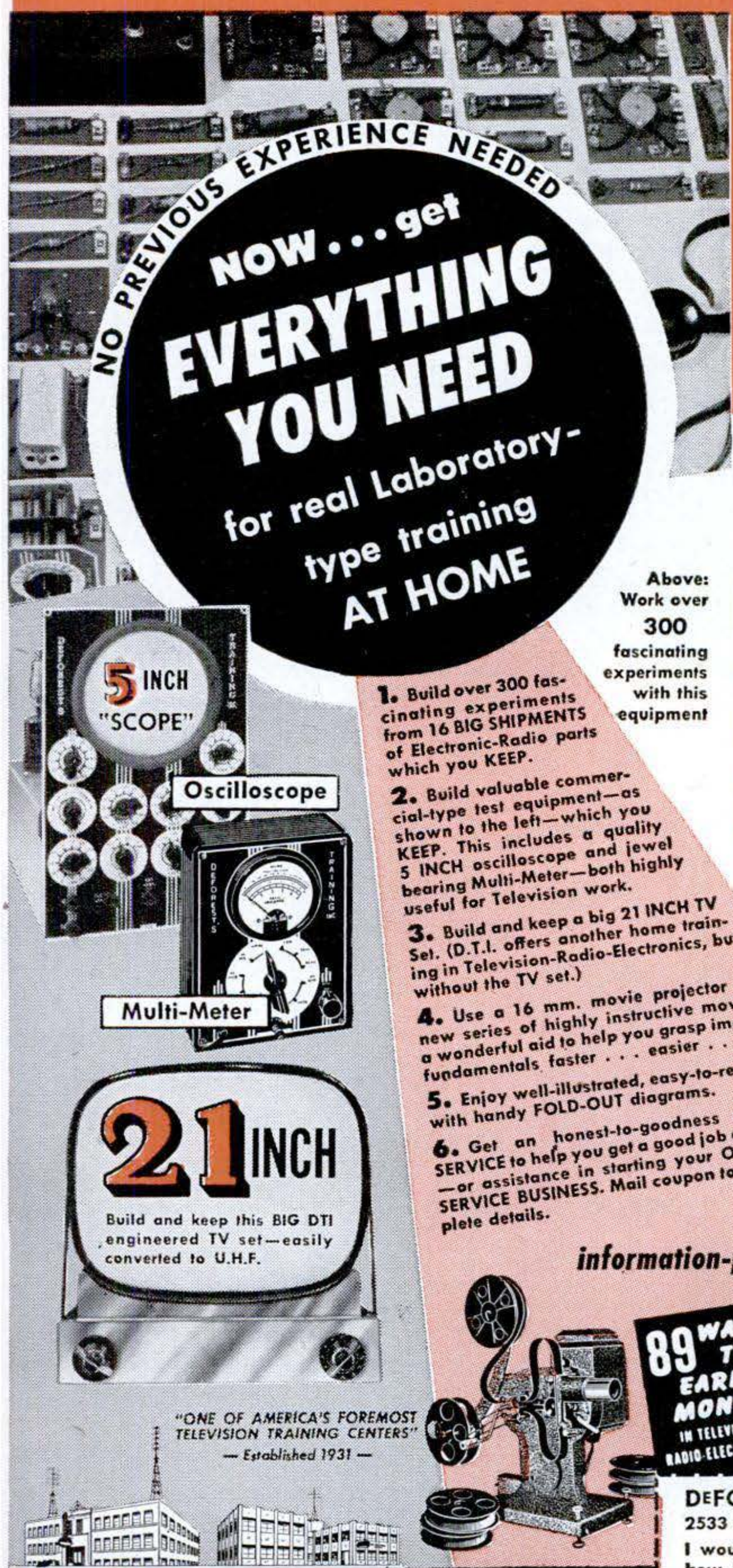

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often exceeds 200 feet in length and takes 34 hours to complete the trip.

JAMES G. FAIRCHILD
Tinamba, N. Gippsland, Victoria, Australia.

For the latest news of road trains, see page 151.

Versatile Diesel

In the July issue of your good magazine on page 114 in an article entitled "Newest Airplane Engine Weds Turbine and Diesel" there is a regrettable misstatement, as follows:

"In the past, the two-stroke [cycle] has not been used for compression ignition because of the difficulty of getting a sufficiently high compression ratio."

There are at least 10 diesel-engine manufacturers in this country who build two-cycle diesel engines and have built and marketed them successfully for years.

J. W. BROWN, Detroit Diesel Engine Division
General Motors Corp., Detroit.

Two-cycle diesel engines are, of course, widely used in trucks, buses, tractors, tugboats, road-building machinery, self-powered rail cars, etc. Careless editing omitted from the sentence quoted by Mr. Brown the vital words "in aircraft."

GI Ingenuity

One night near the front lines in Korea someone mistakenly filled a little gasoline engine, used to charge radio batteries, with stove fuel. The place to drain the tank was

too close to the engine to get a container under. So, failing to find a hose, I used a handsaw, placed the handle end under the tank, the small end in a can—and drained the tank without spilling a drop.

CPL. MARVIN A. JOHANSEN
APO 86, San Francisco.

Hard Reading

To see your magazine a week after it gets out here to the far Pacific, you would think

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How I foxed the Navy

by Arthur Godfrey

The Navy almost scuttled me. I shudder to think of it. My crazy career could have ended right there. Who knows, I might still be bumming Chesterfields instead of selling them.

To be scuttled by the Navy you've either got to do something wrong or neglect to do something right. They've got you both ways. For my part, I neglected to finish high school.

Ordinarily, a man can get along without a high school diploma. Plenty of men have. But not in the Navy. At least not in the U. S. Navy Materiel School at Bellevue, D. C., back in 1929. In those days a bluejacket had to have a mind like Einstein's. And I didn't.

"Godfrey," said the lieutenant a few days after I'd checked in, "either you learn mathematics and learn it *fast* or out you go. I'll give you six weeks." This, I figured, was it. For a guy who had to take off his shoes to count above ten, it was an impossible assignment.

I was ready to turn in my bell-bottoms. But an ad in a magazine stopped me. Here, it said, is your chance to get special training in almost any subject—mathematics included. I hopped on it. Within a week I was enrolled with the International Correspondence Schools studying algebra, geometry and trig for all I was worth.

Came week-end liberty, I studied. Came a holiday, I studied. Came the end of the six weeks, I was top man in the class. Within six weeks I had mastered two years of high school math, thanks to the training I'd gotten.

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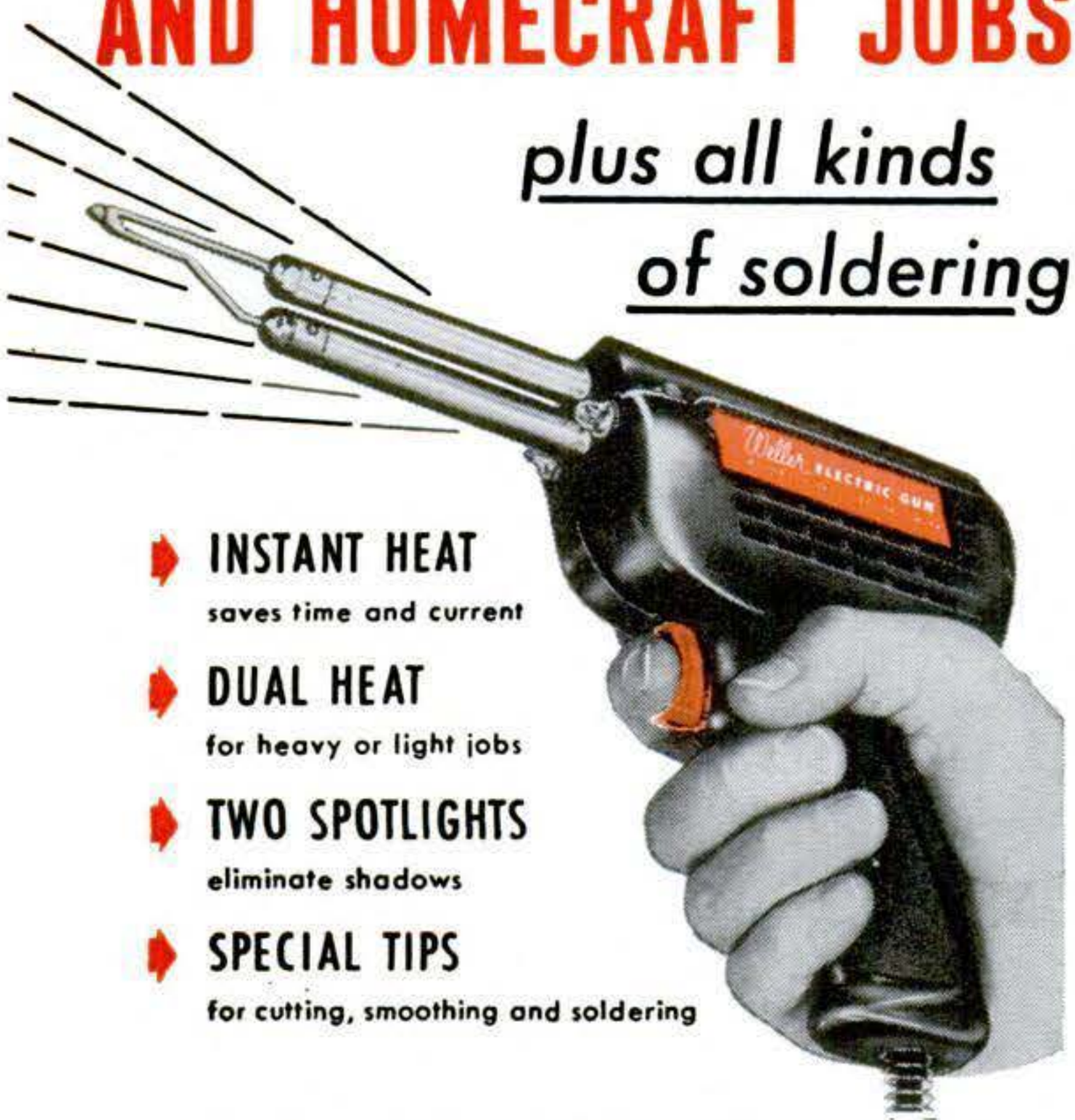

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it must have contained a good collection of pin-up pictures: corners worn, articles cut out, everything to indicate much use. I think that's a good indication of how well we like it.

FLOYD E. EVANS, M.E.C., USS *Valley Forge*
FPO, San Francisco.

Another Way to Make 3-D Glasses

In your 3-D story on circular-saw boners [Aug. '53, p. 141] you say not to use viewers from 3-D movies. It's true that Polaroid filters won't show the printed pictures, but I turned the frames of the better type of movie viewers to good use. Tearing out the Polaroid, I cemented in dyed photo film.

Result: de luxe red-and-green viewers with which to enjoy the PSM anaglyphs.

WALTER P. MAGMA, Hollywood.

One-Way Ticket—Up

In your article on "Man-Made Meteors" [July, p. 93] it is said, "To overcome the earth's gravitational pull and escape into outer space, you must attain a speed of almost seven miles a second."

This statement confuses gunnery with rocketry. A missile, having no power plant, would have to reach an "escape velocity" of seven m.p.s. On the other hand, a rocket could, theoretically, leave earth's gravitational pull at a *slow walk* if you could keep up just enough *power* to overcome earth's gravitation, the controlling factor being, of course, fuel. Right?

ED SCHWARTZ, Burbank, Calif.

Right—theoretically. In practice, a rocket like a V-2 consumes its nine tons of fuel in its first minute of flight, then coasts to extreme altitude like a missile from a gun. Until rocket men find a practically inexhaustible fuel, their rockets will have to reach that "gunnery" figure of seven m.p.s. to leave Mother Earth for keeps.

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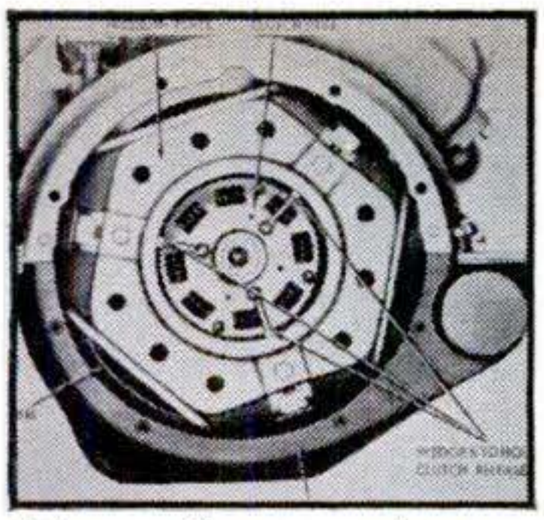
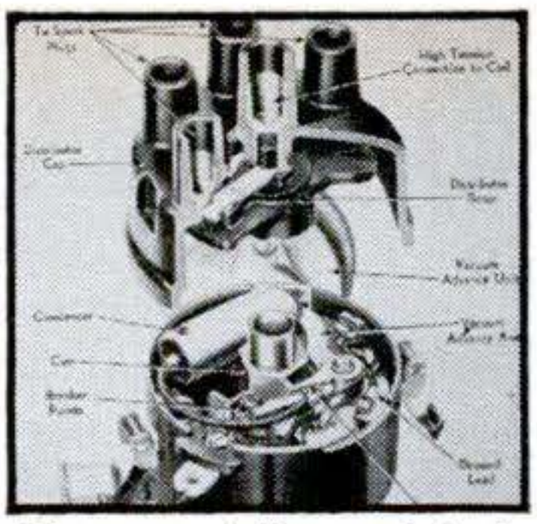
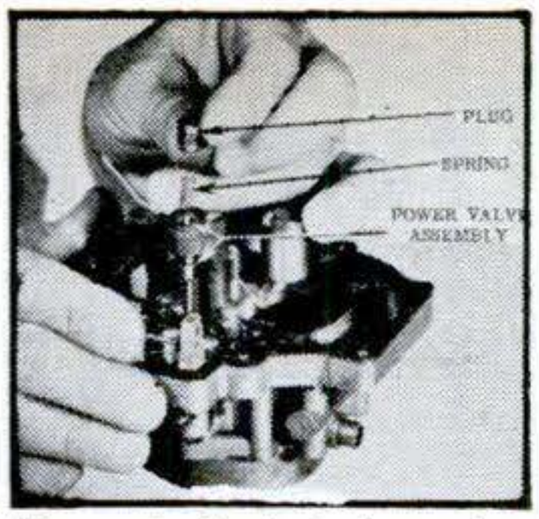


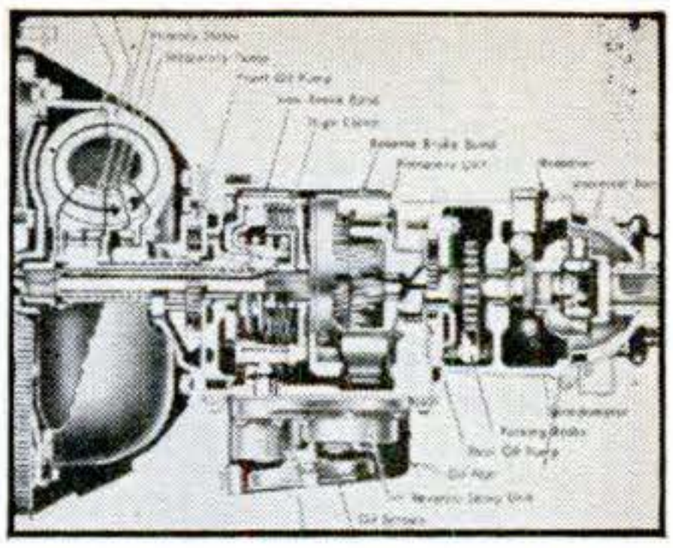
Cut-away diagrams make every operation easy. Above — Ford clutch.



Diagrams, tables and text take the "mystery" out of all ignition systems.



You get illustrated repair procedures for all types of carburetors.



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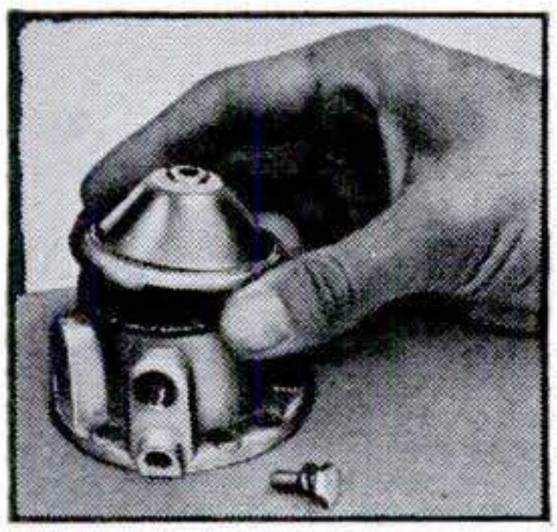
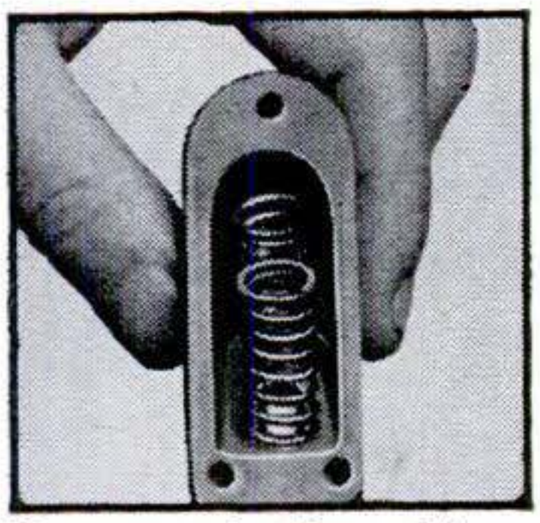


Fuel pumps can cause trouble. Pictures show exactly how to take them apart, fix them.



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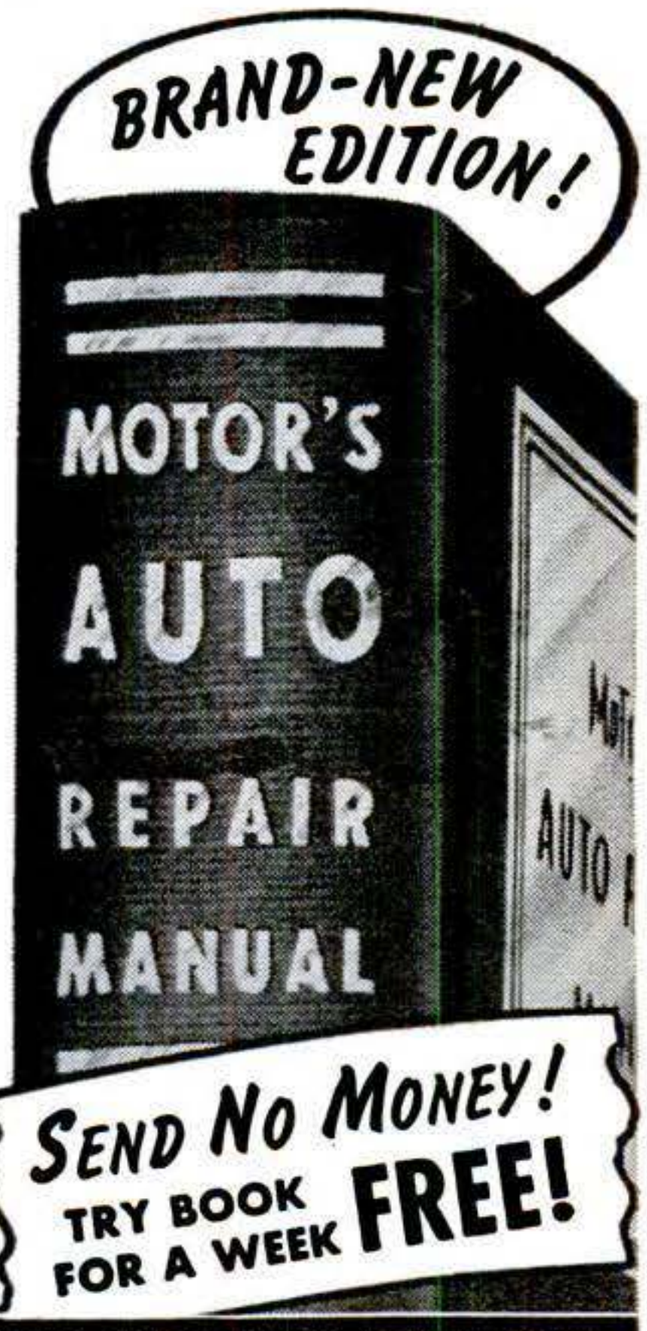

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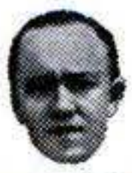

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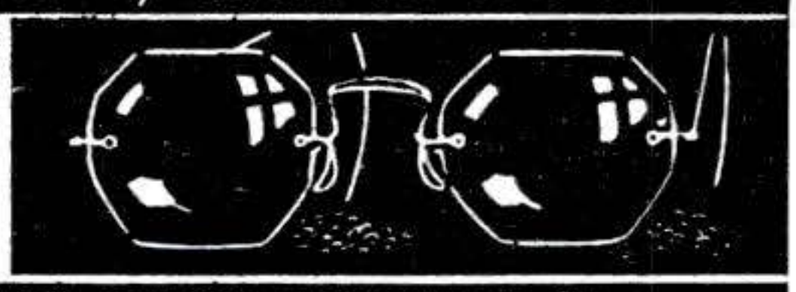

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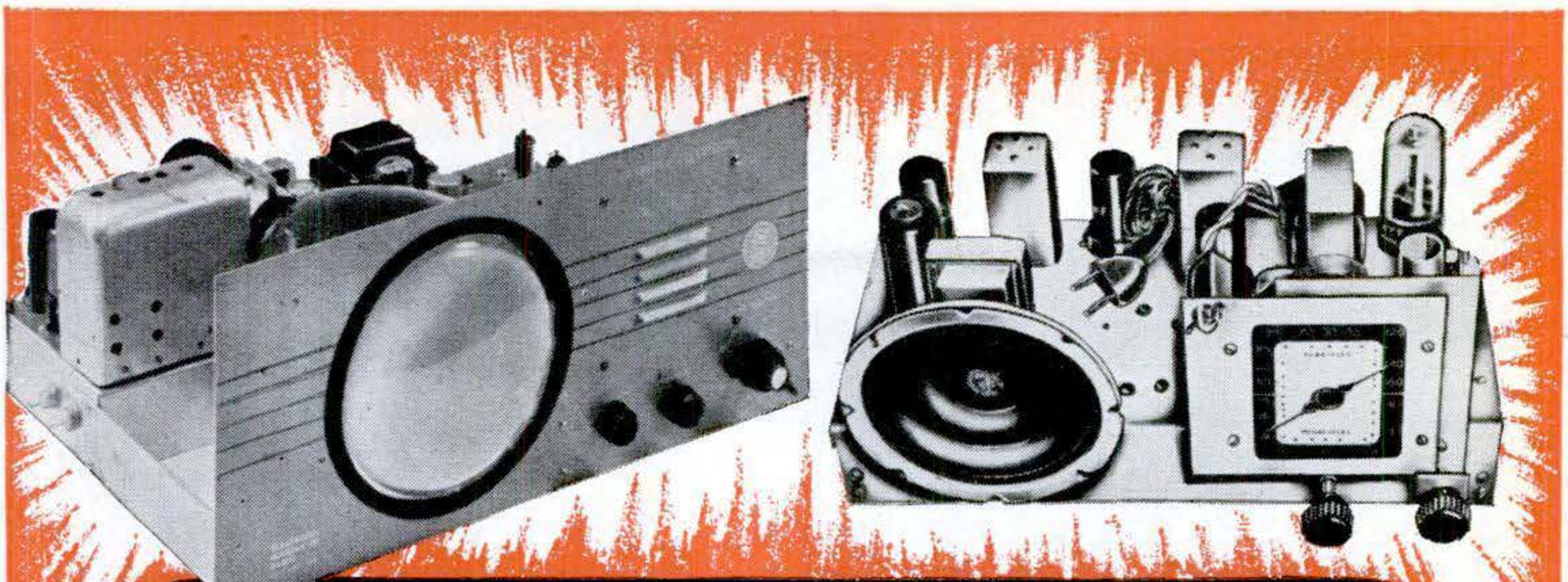

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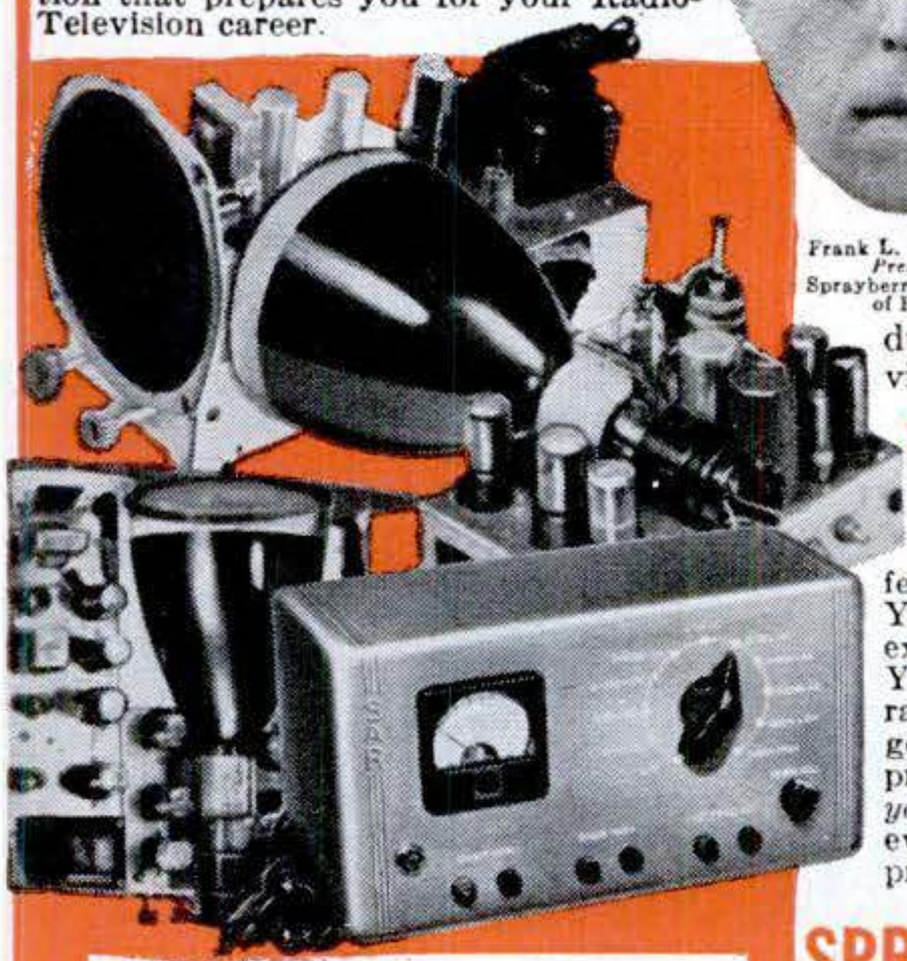

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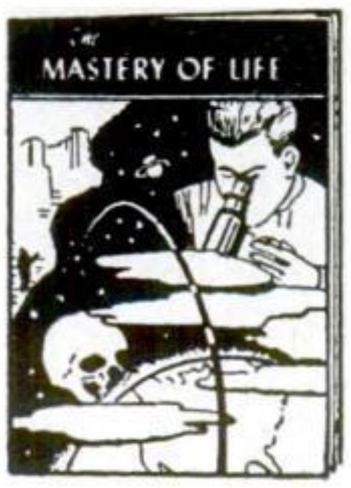

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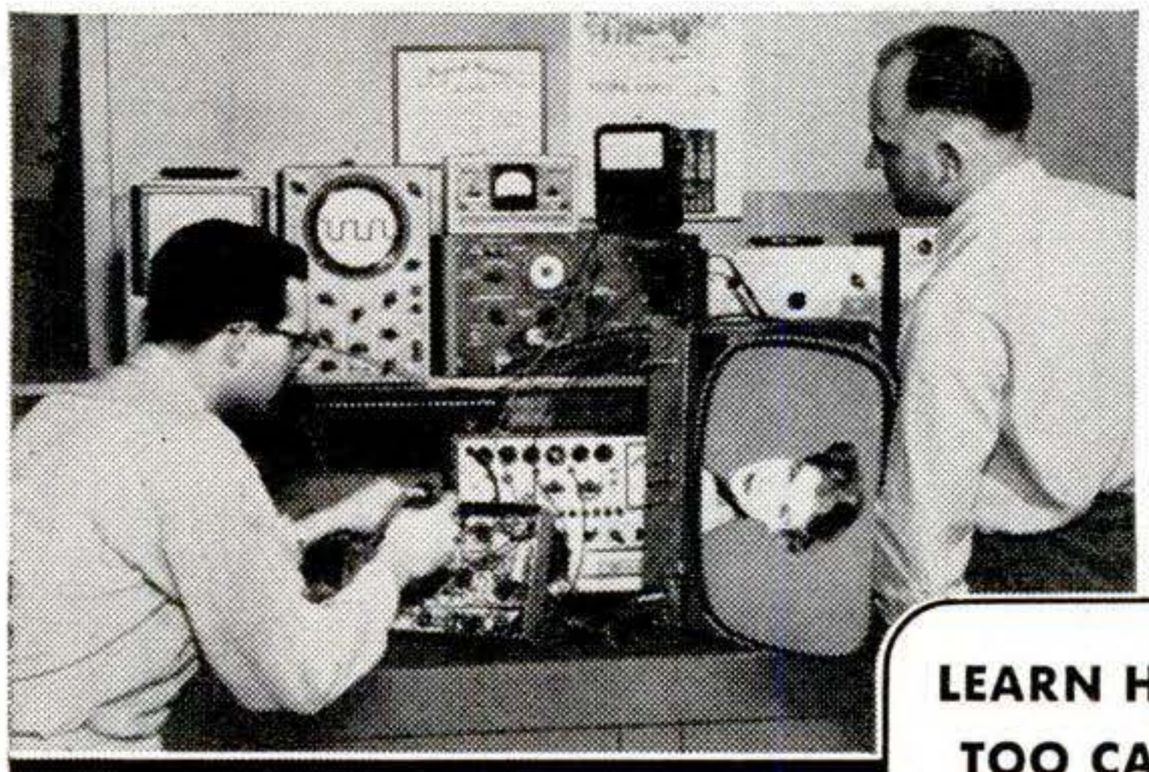

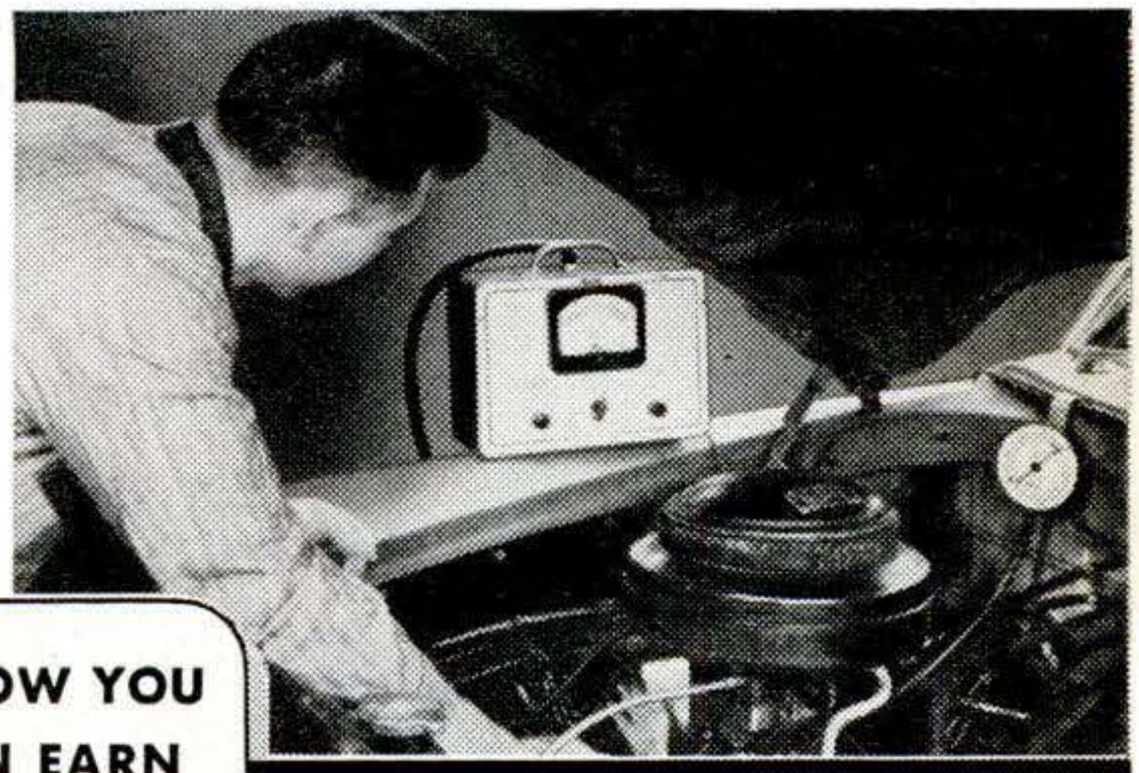

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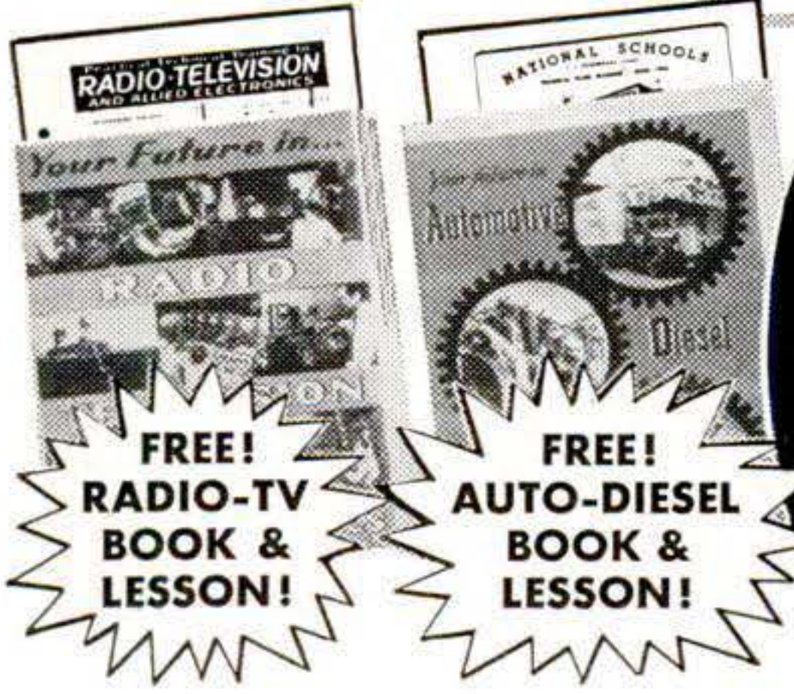

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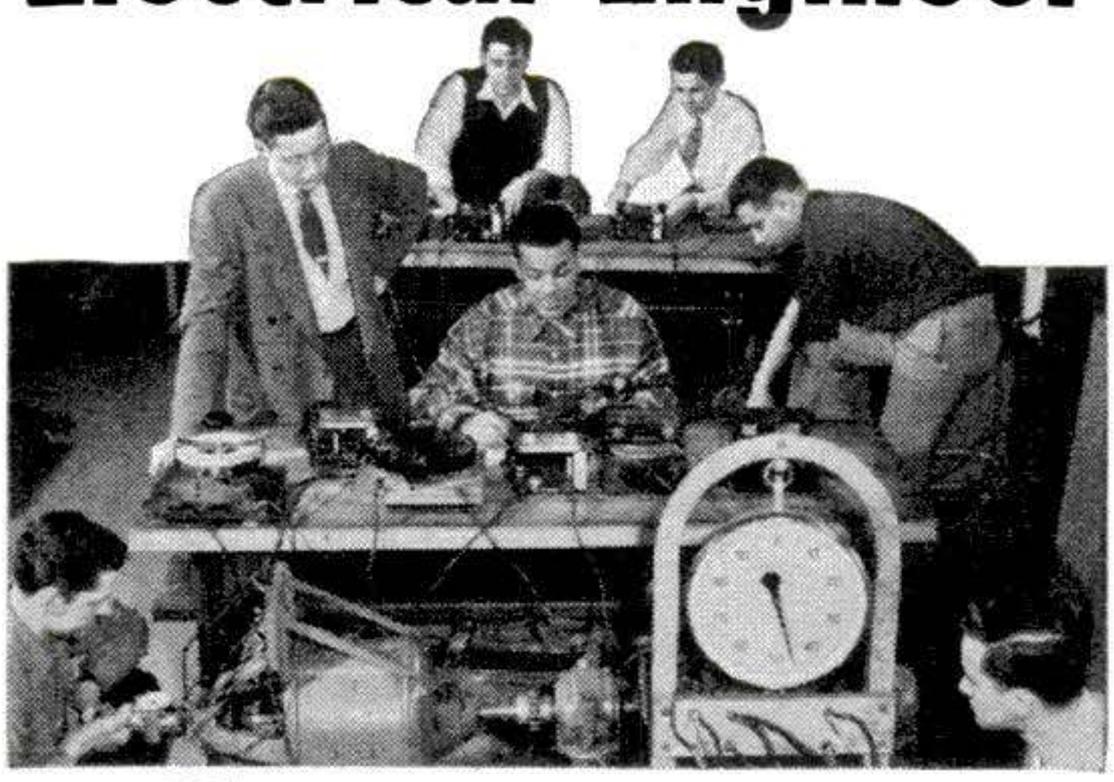

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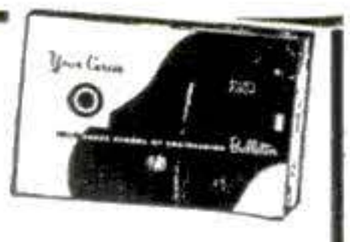

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525-18	5.00	820-15	6.65	600-20	8.75	1100-20	19.55
550-17	4.95	670-16	6.35	650-20	10.25	1000-22	19.45
650-15	5.35	760-16	7.15	32x6(8)	11.35	1100-22	20.45
700-15	5.45	700-16(6)	7.65	32x6(10)	11.75	1200-20	29.95

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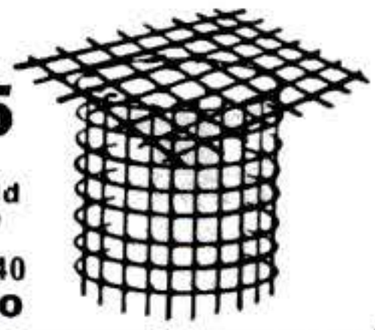

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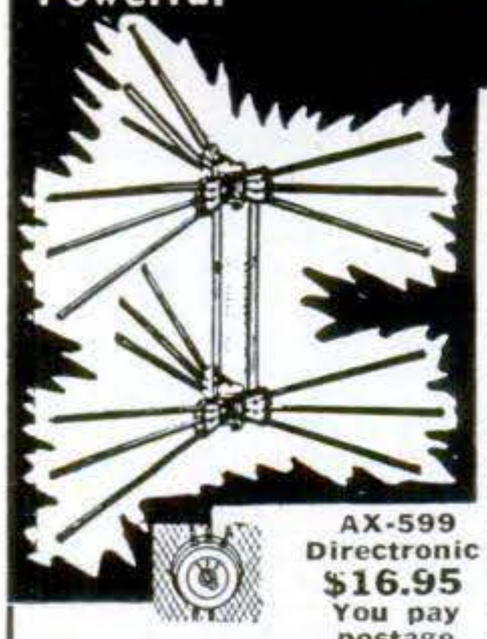

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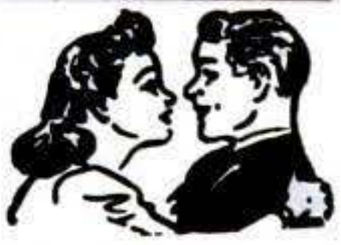

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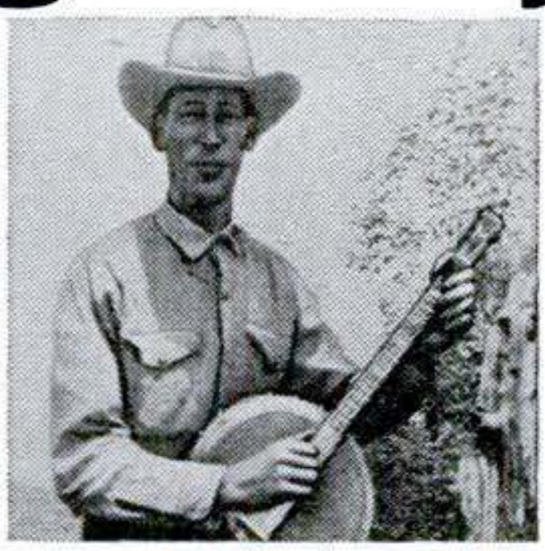
Course Inspires Music Circle

Shown above is Miss Mildred Cade, of Houston, Texas. She and a number of her friends are so enthusiastic about the U. S. School of Music's quick easy way of learning that they've ALL taken it up.



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And then they made an amazing discovery! They learned about a wonderful way to learn music at home — without a private teacher — without tedious study — and in a surprisingly short time. They wrote to the U. S. School of Music for the facts about this remarkable short-cut method. And the facts opened their eyes! They were amazed to find how easy it was to learn!

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NOTICE

Please don't confuse our method with any systems claiming to teach "without music" or "by ear." We teach you easily and quickly to play *real music*, any music by standard notes—not by any trick or number system.

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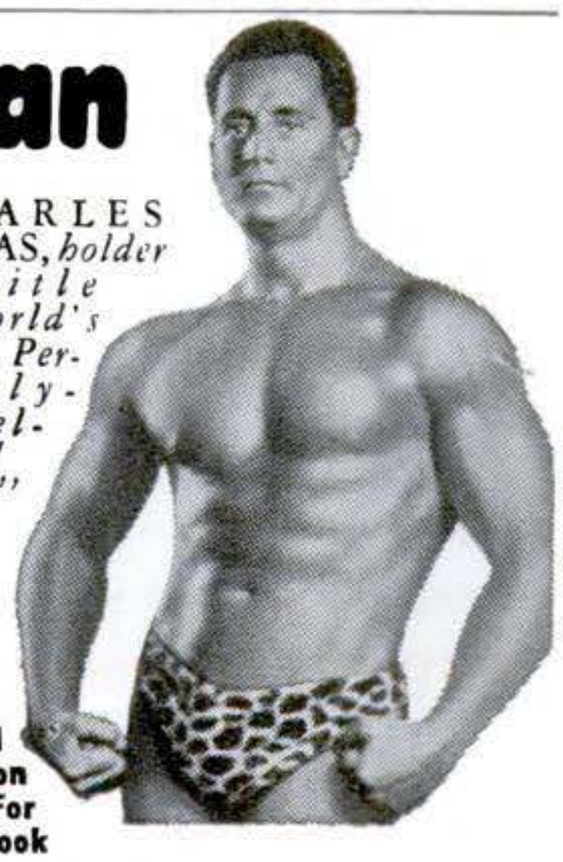

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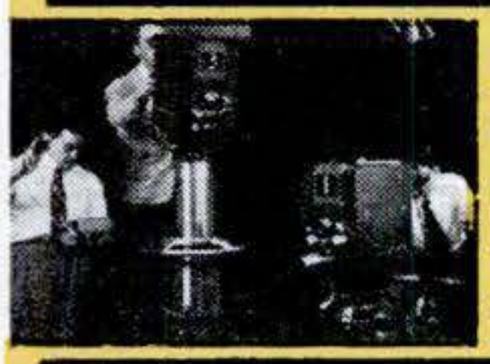

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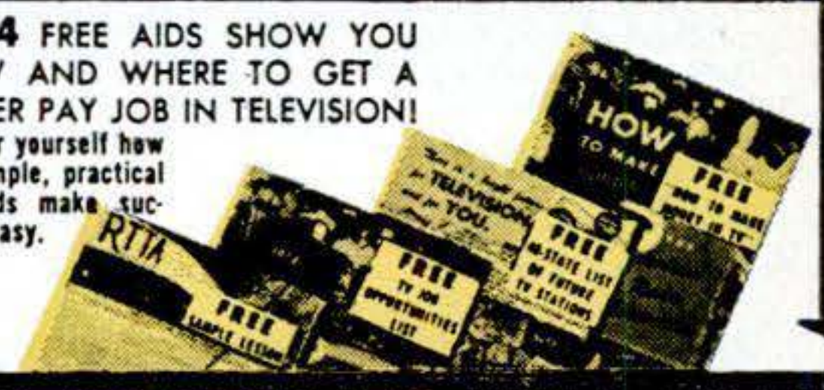

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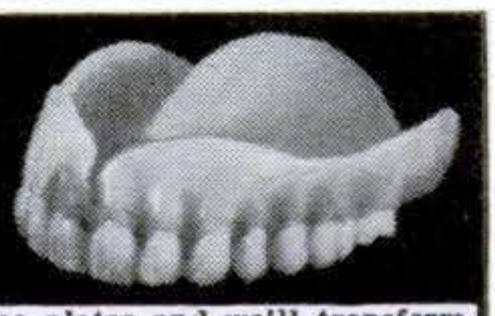

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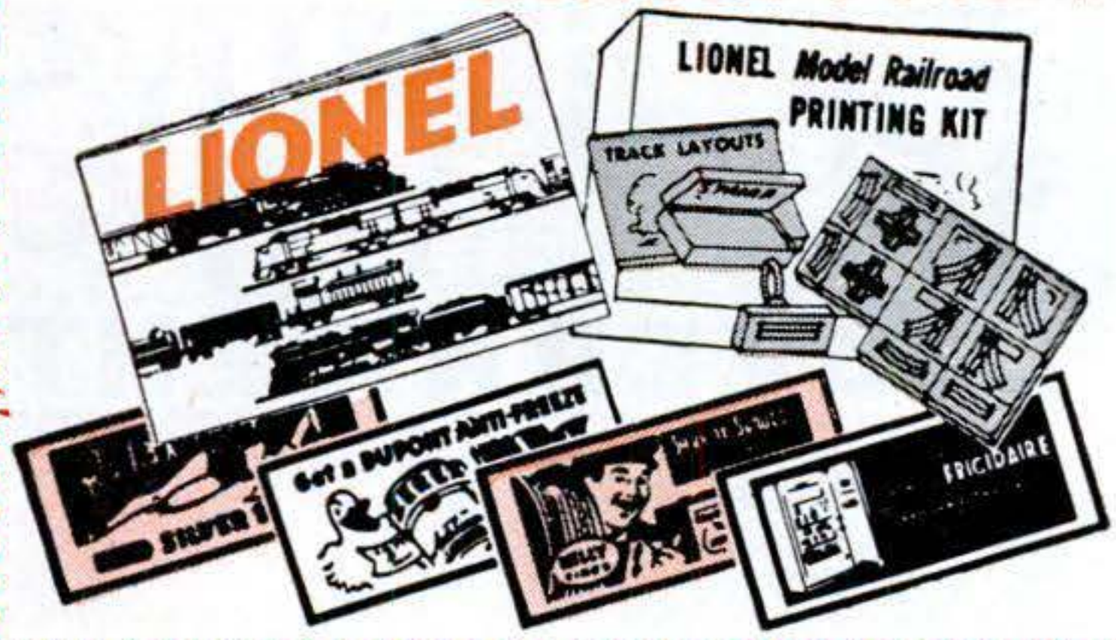

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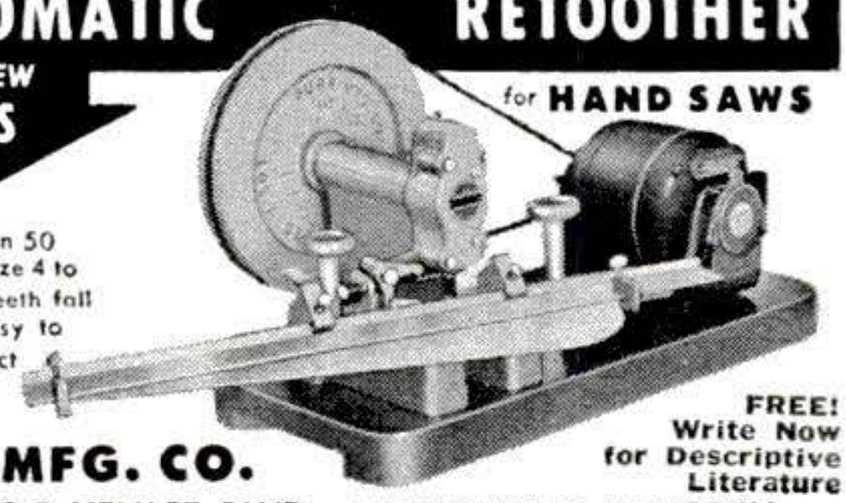

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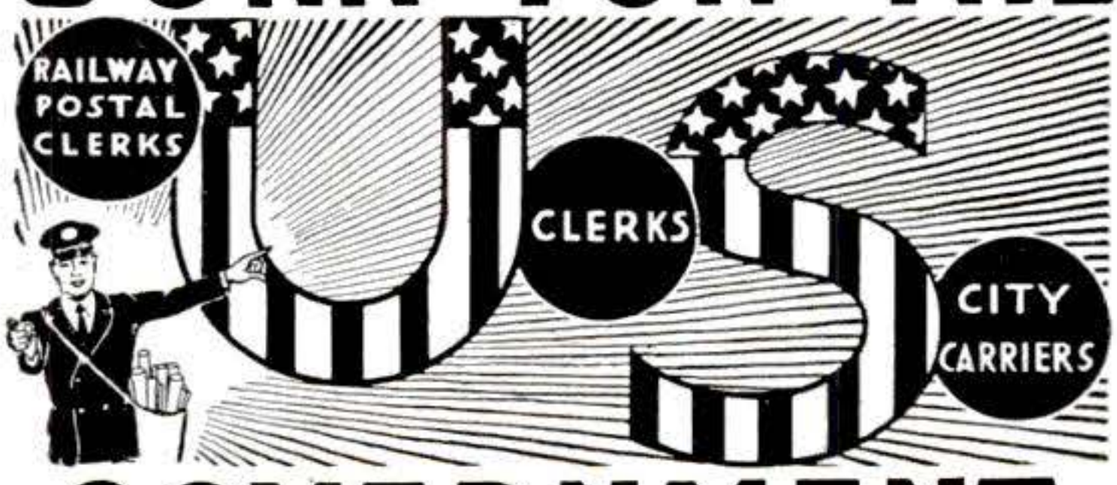

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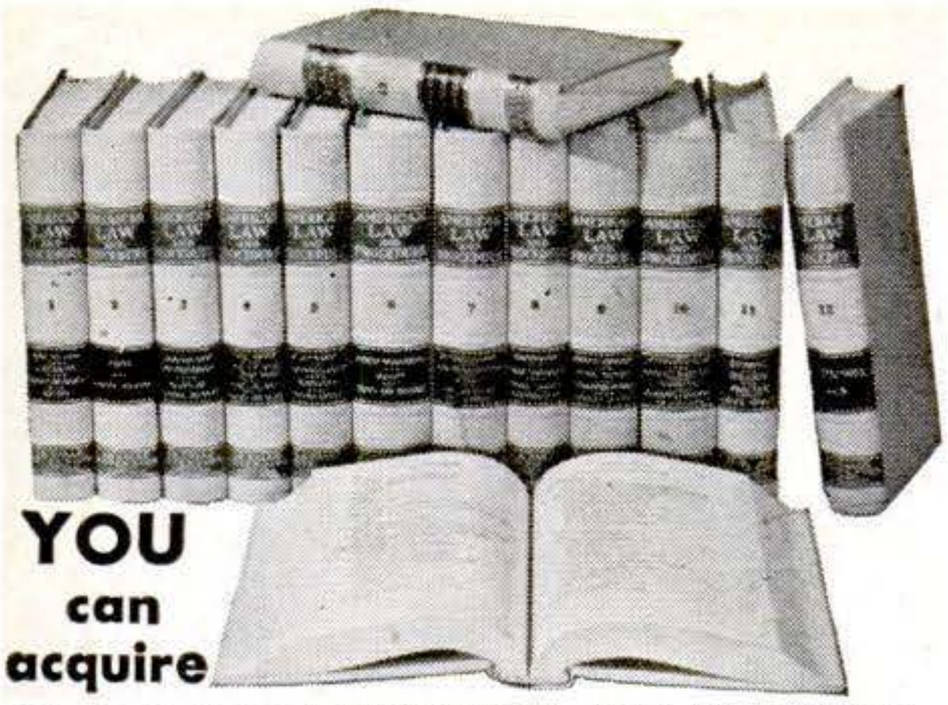

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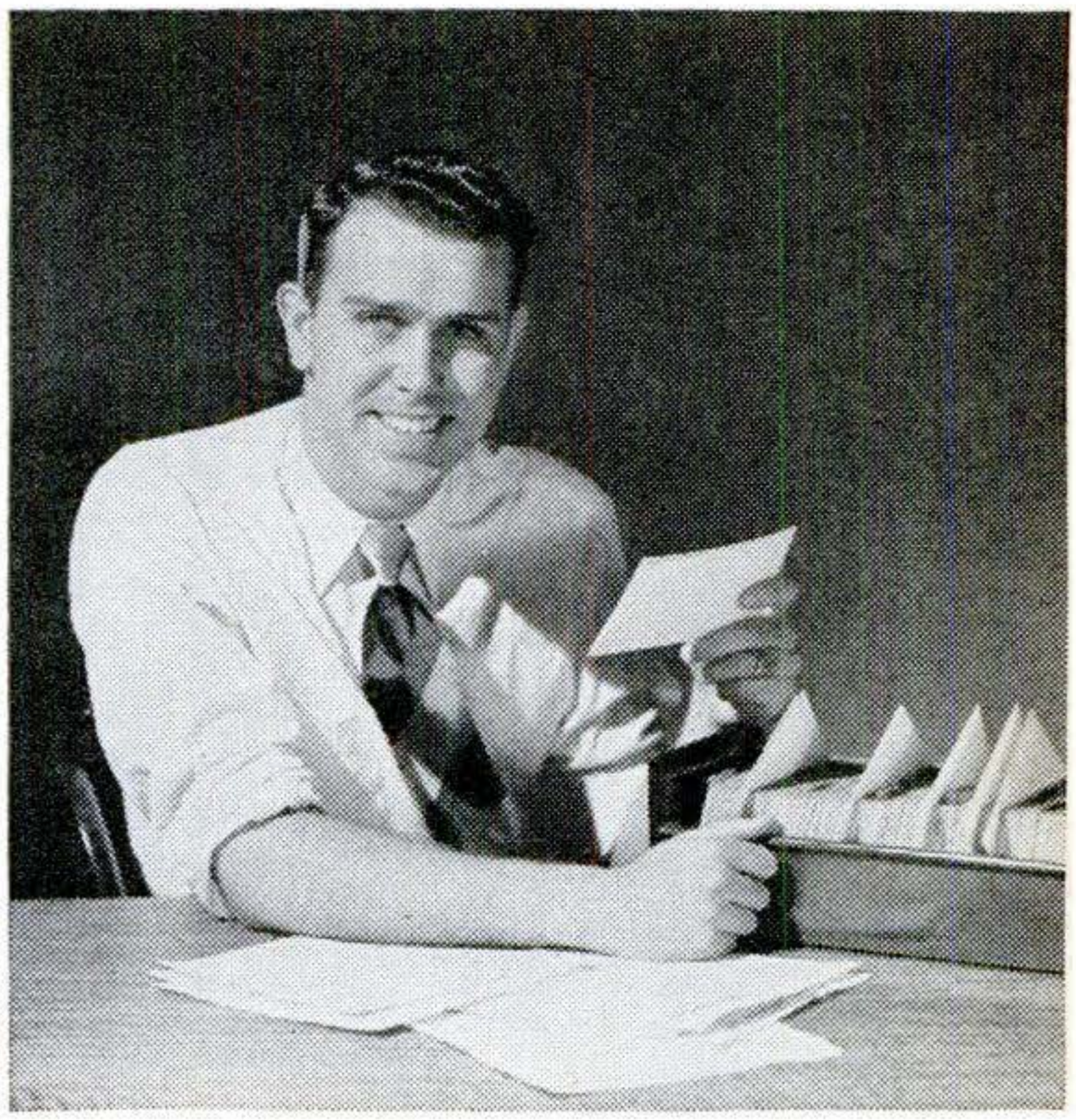

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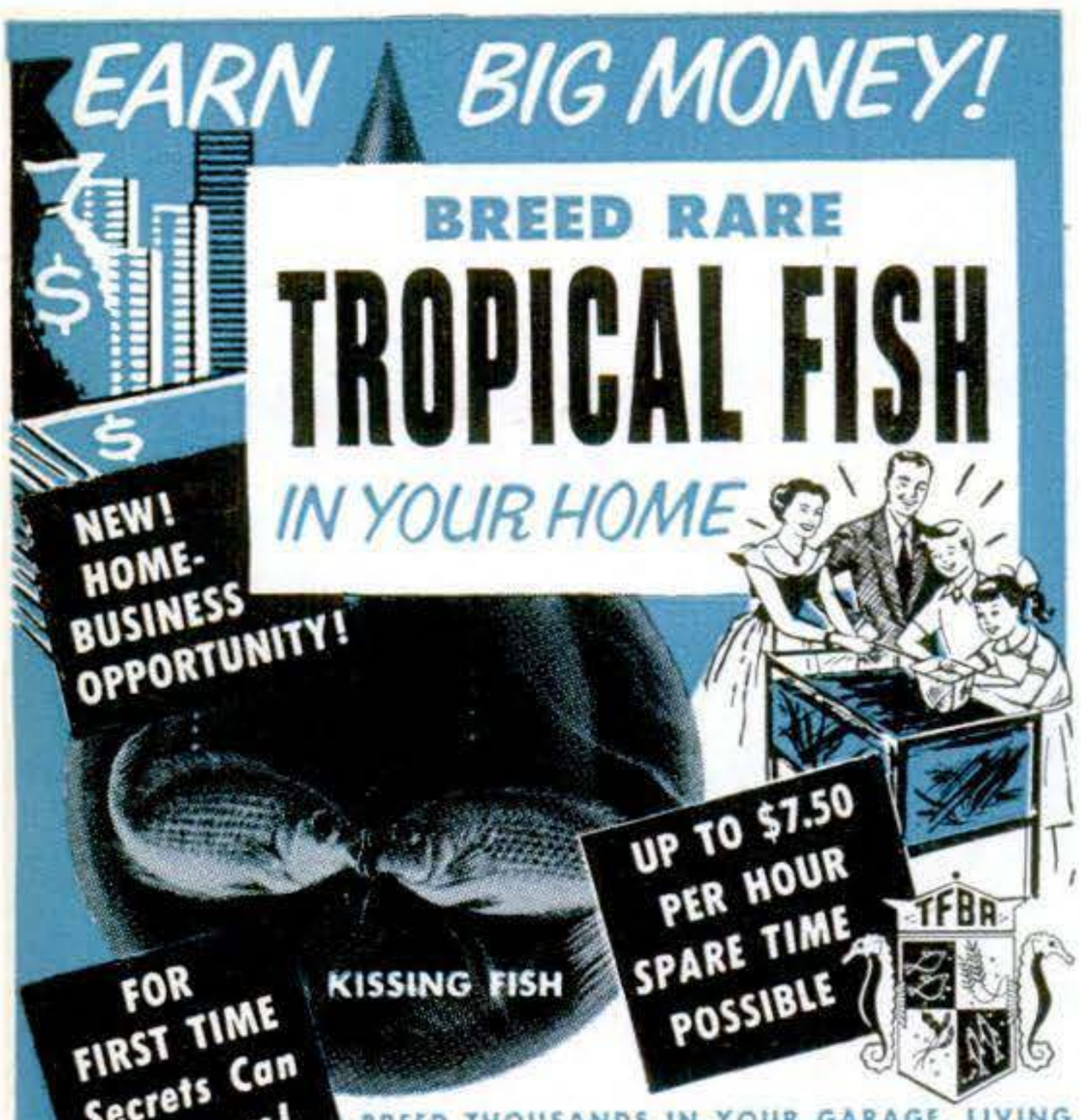

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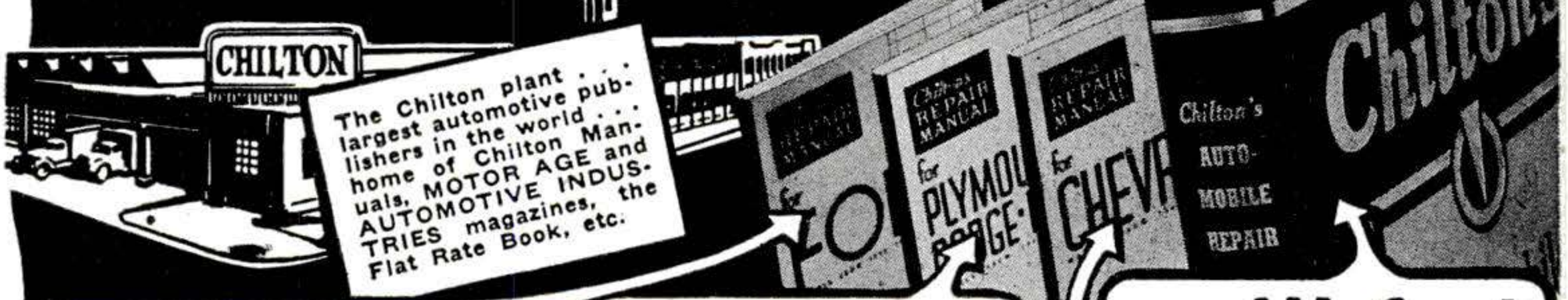

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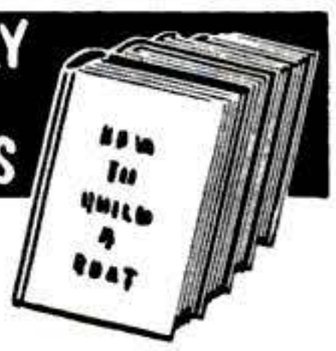

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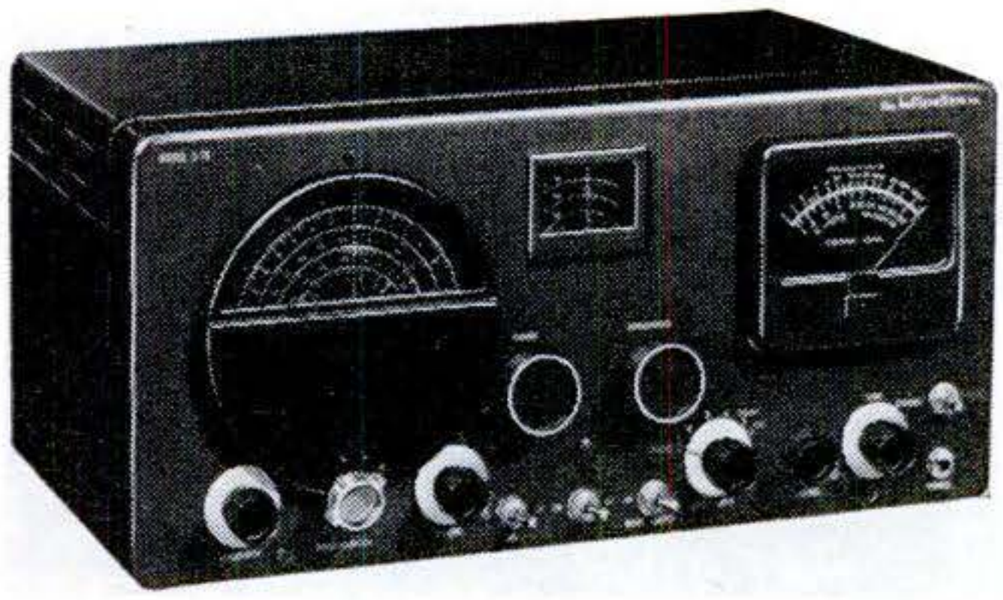

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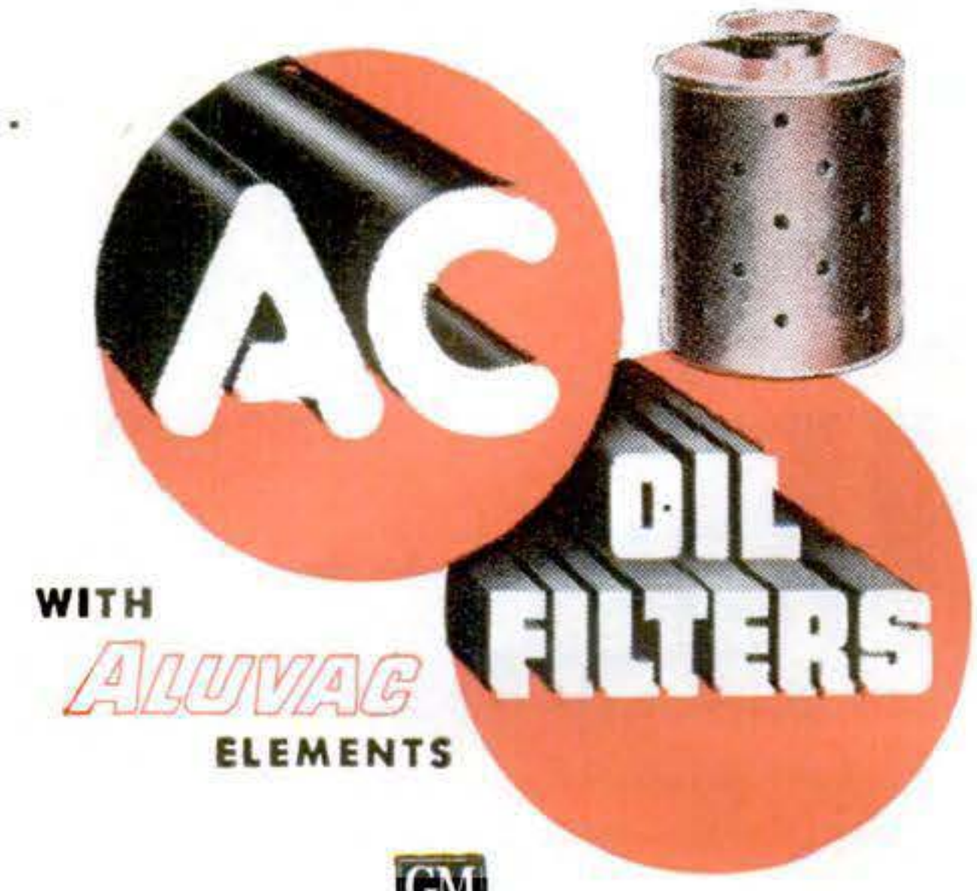

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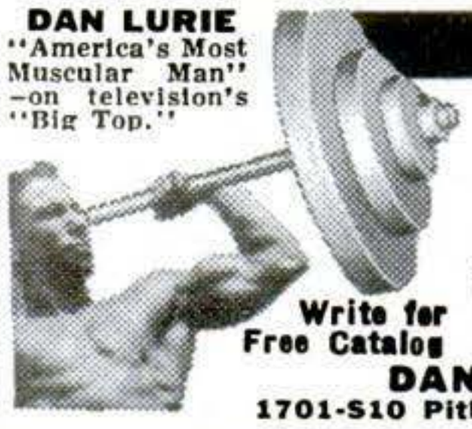

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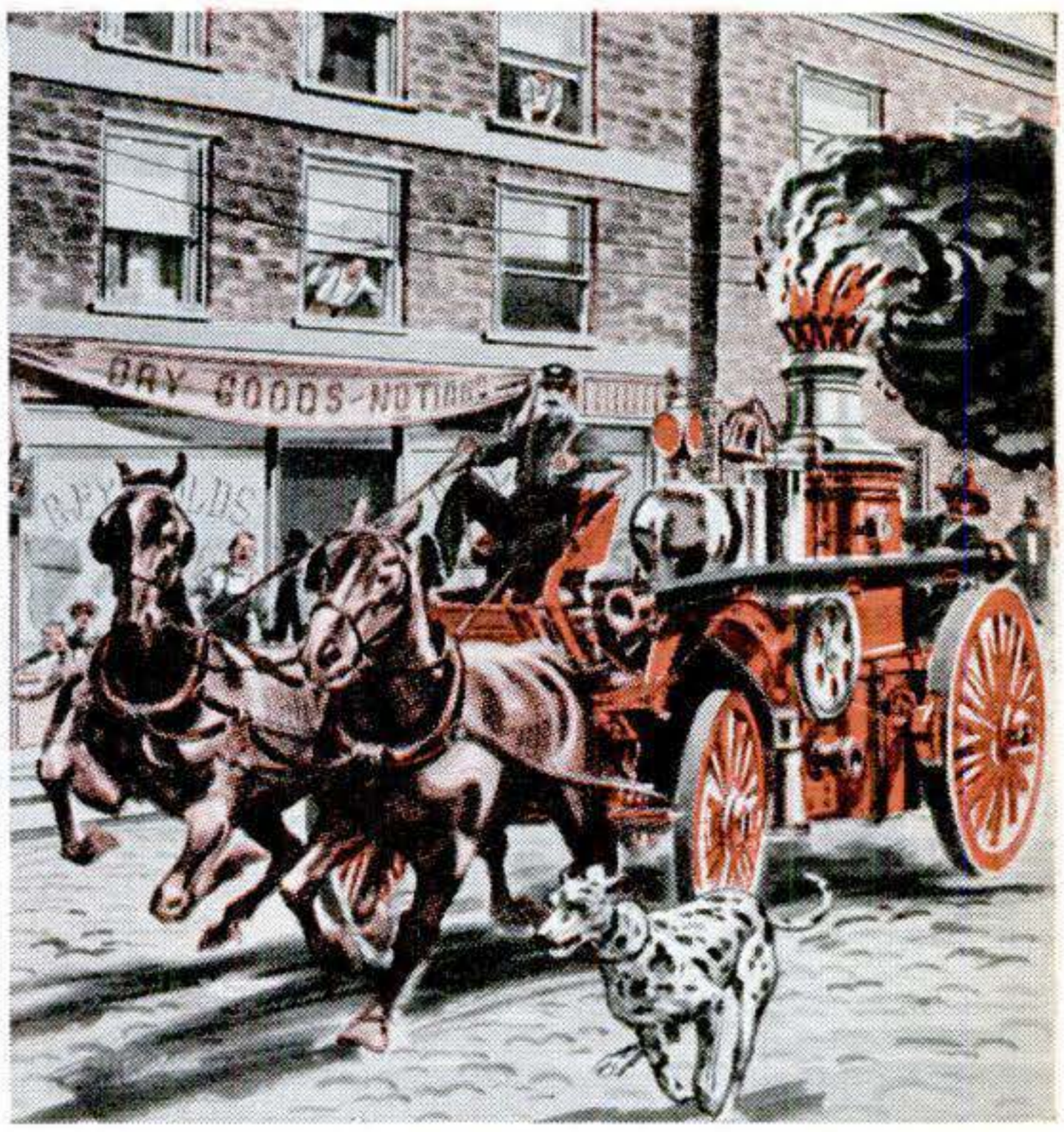

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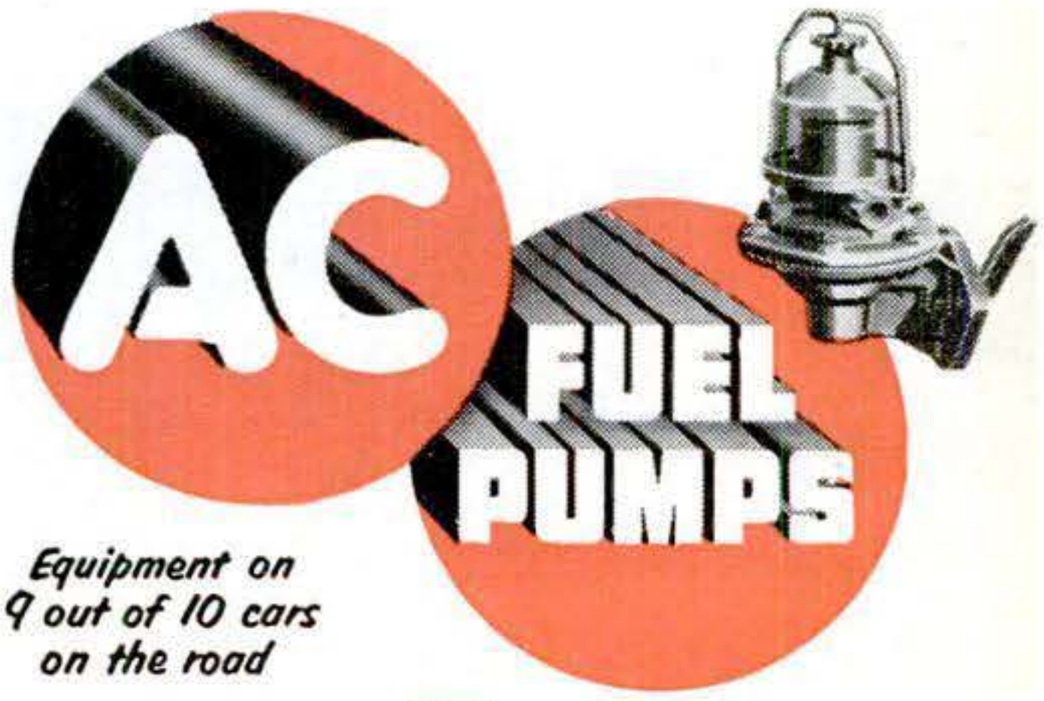

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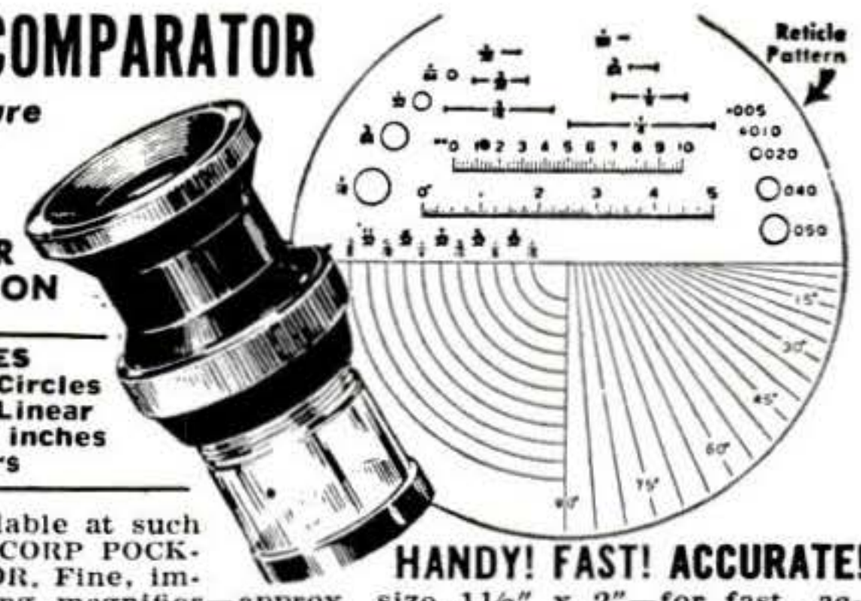

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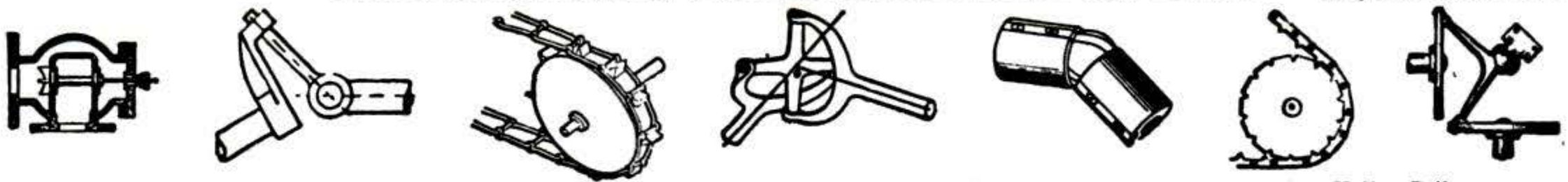

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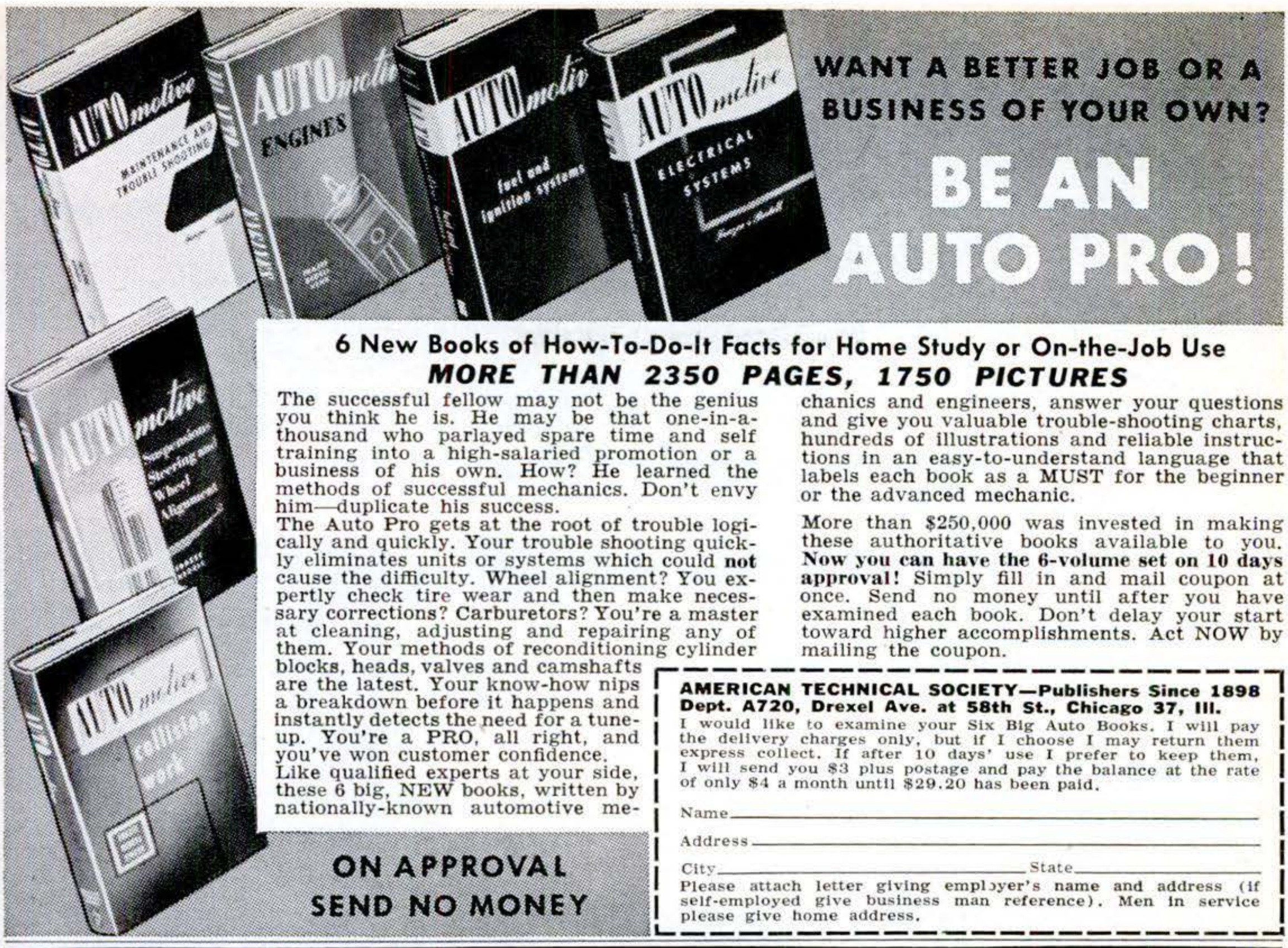

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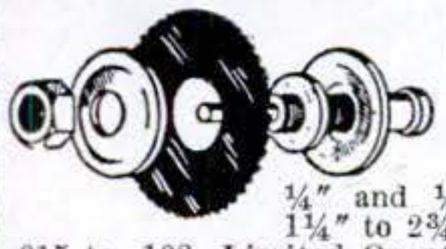

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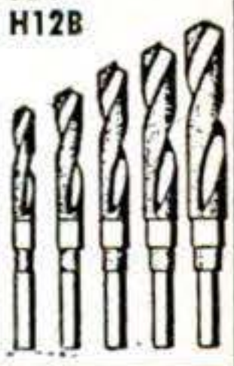

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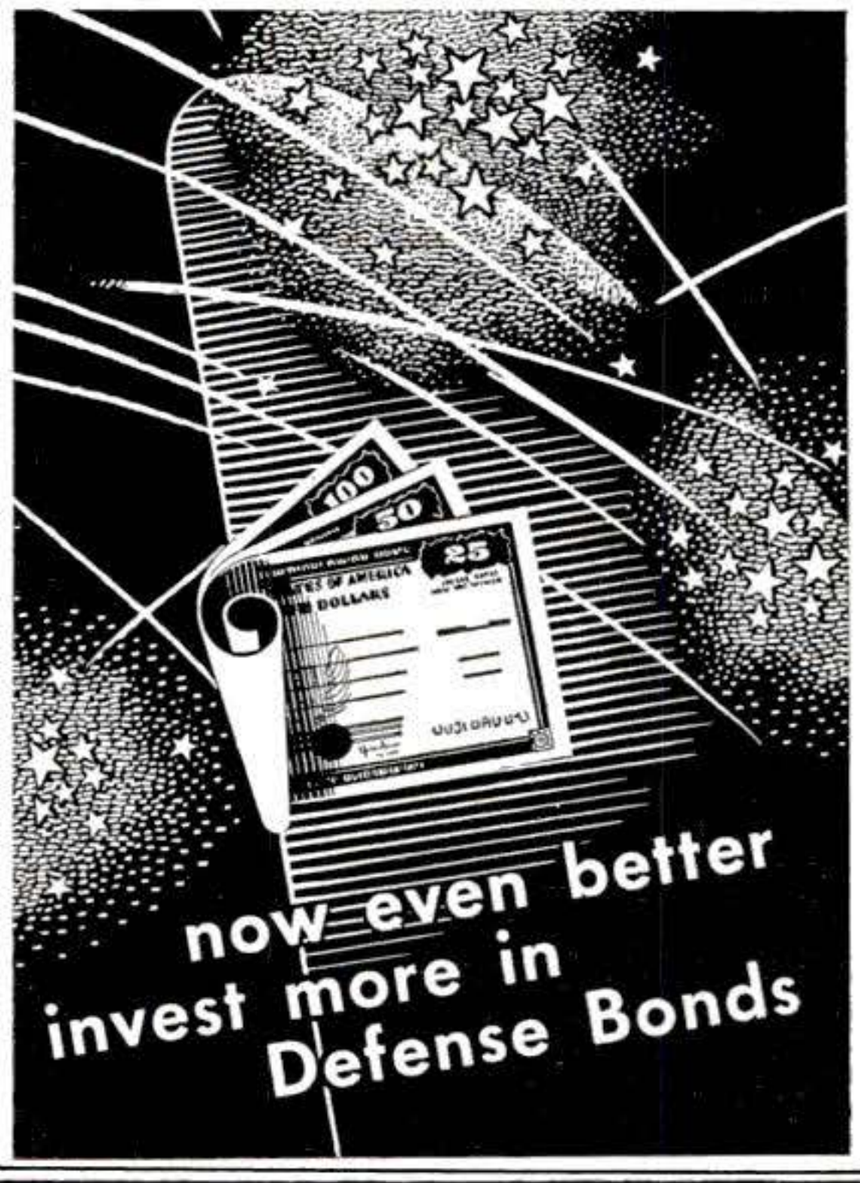

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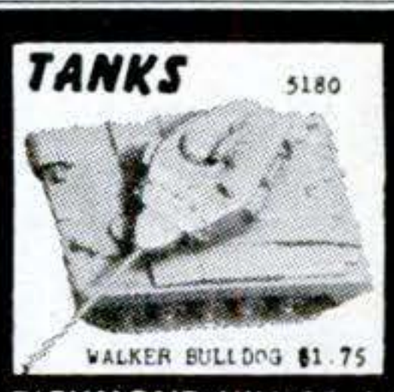

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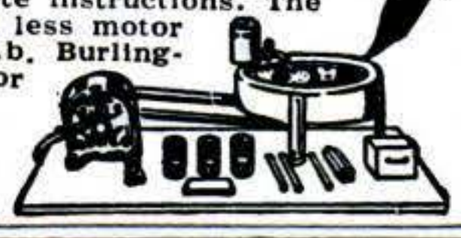

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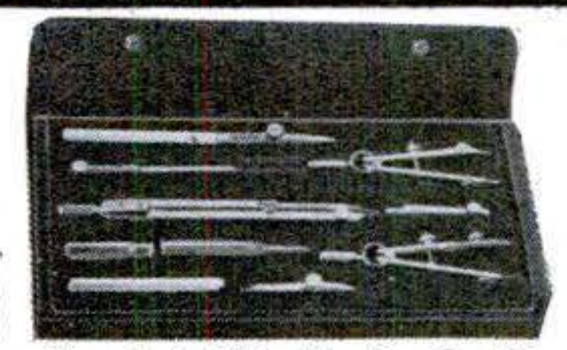

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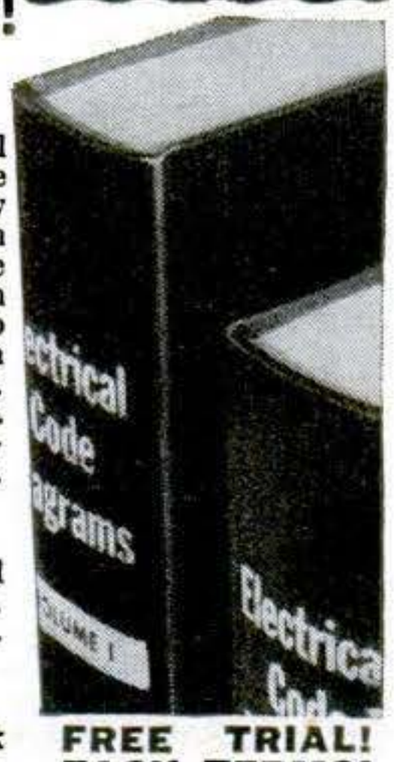

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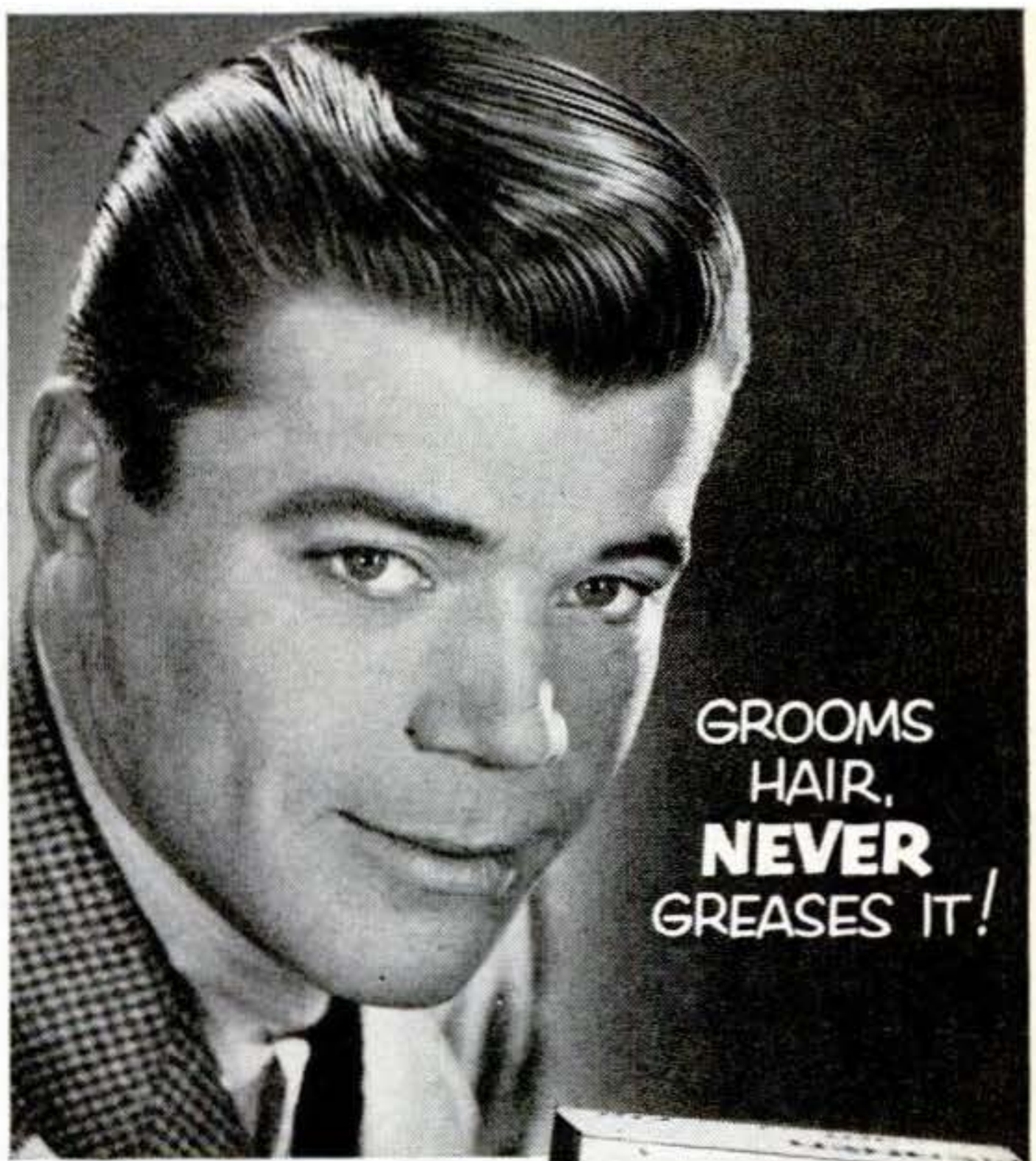

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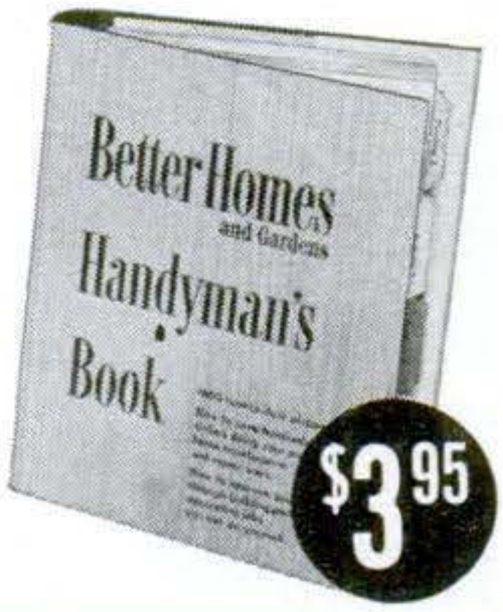

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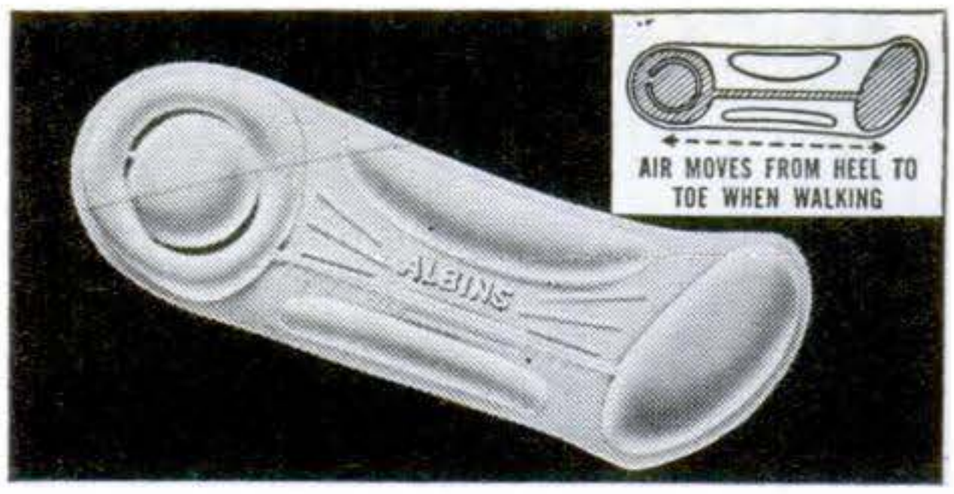

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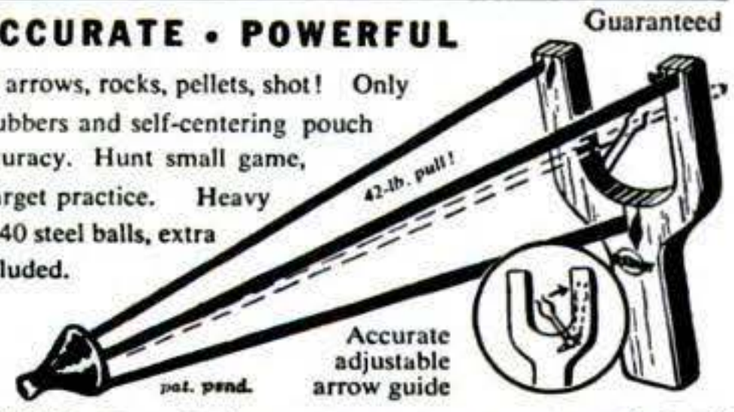

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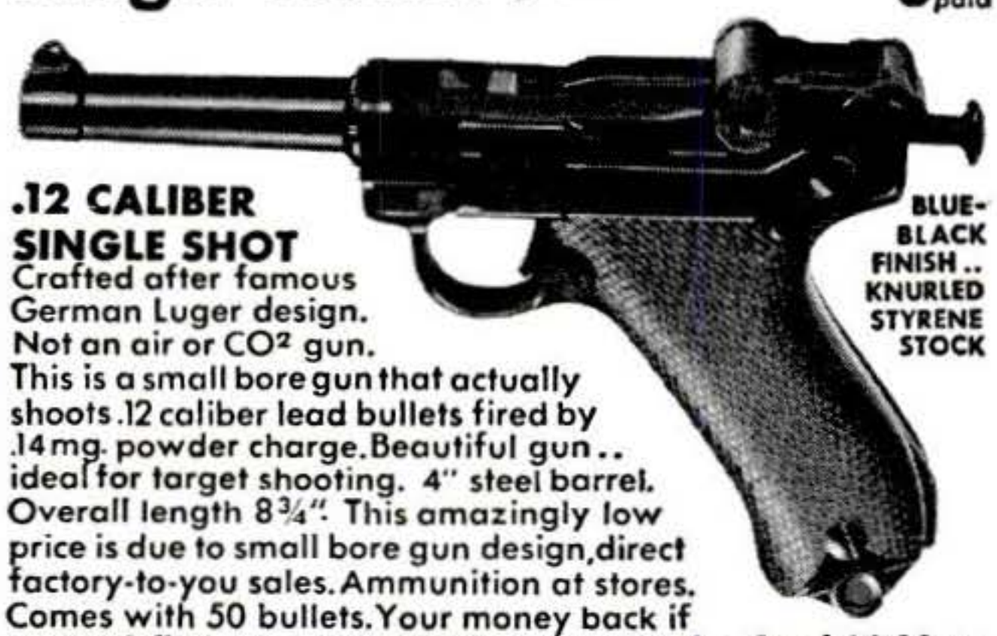

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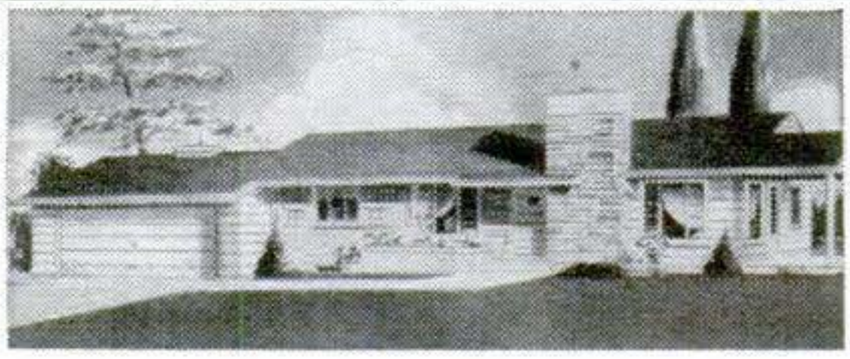

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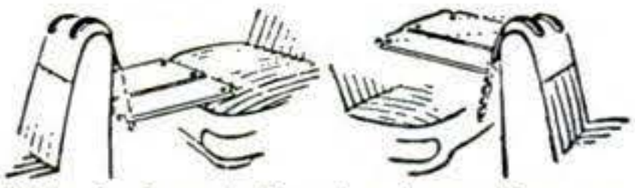

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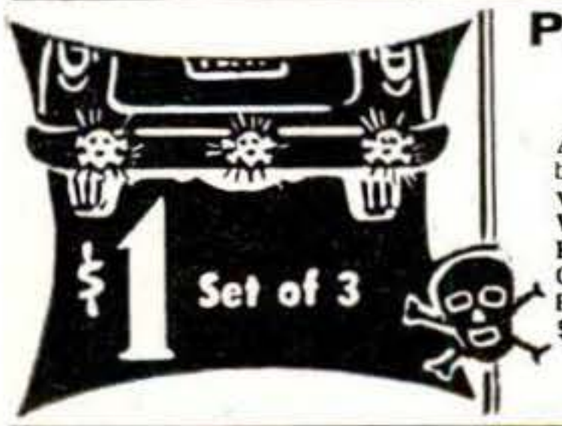

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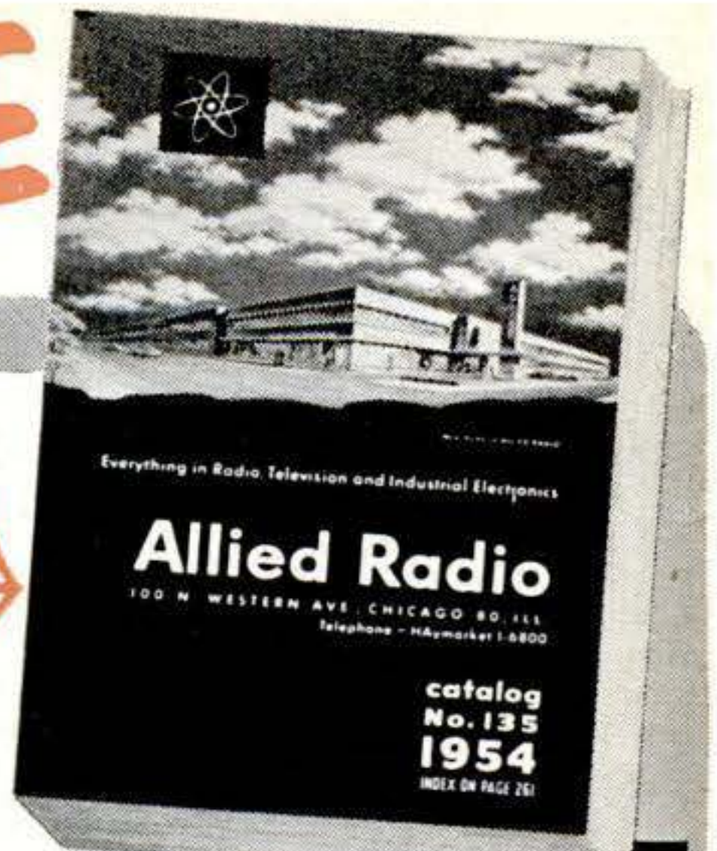

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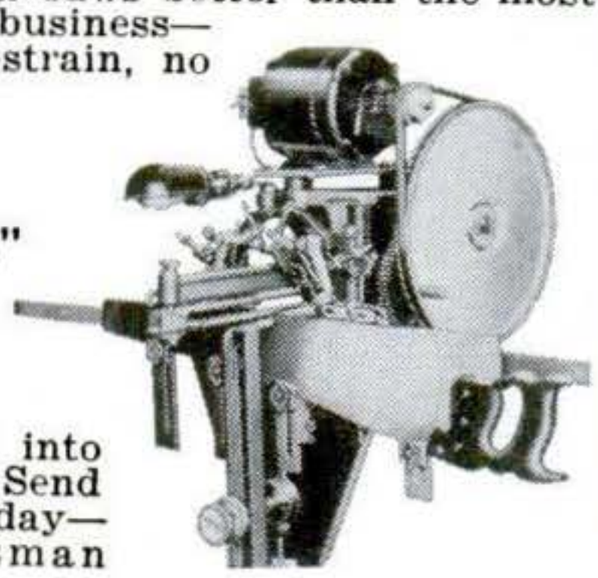

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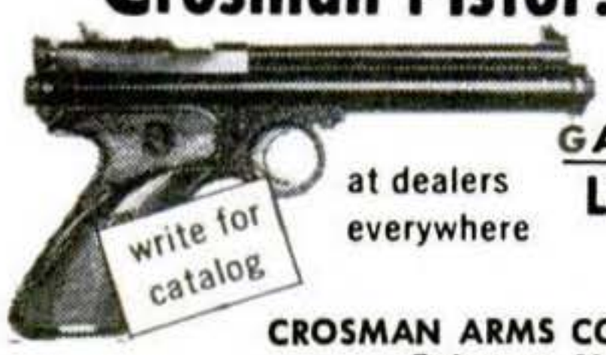

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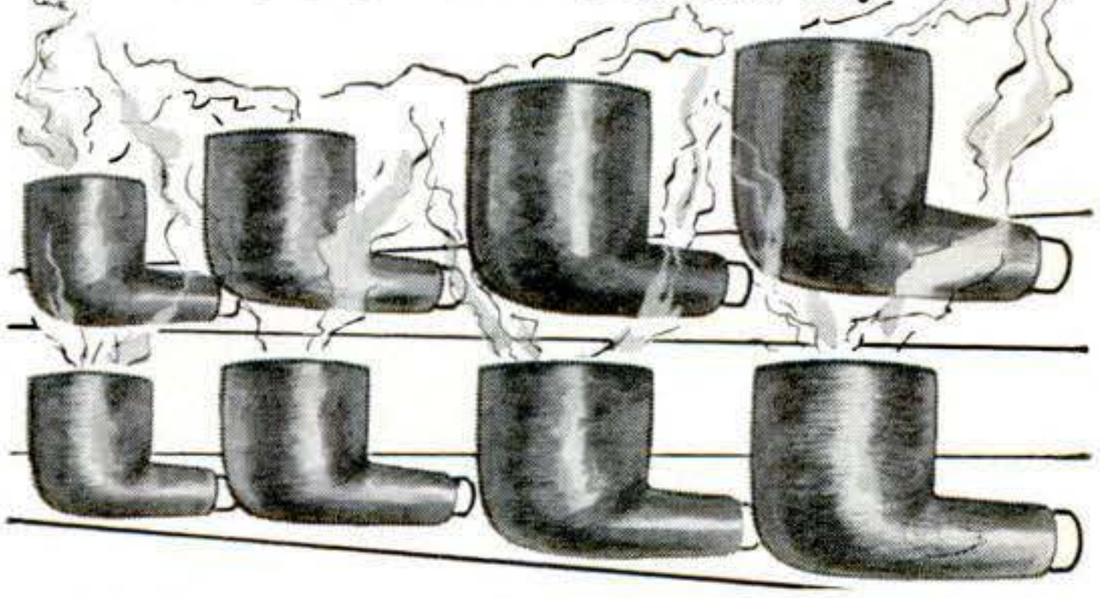

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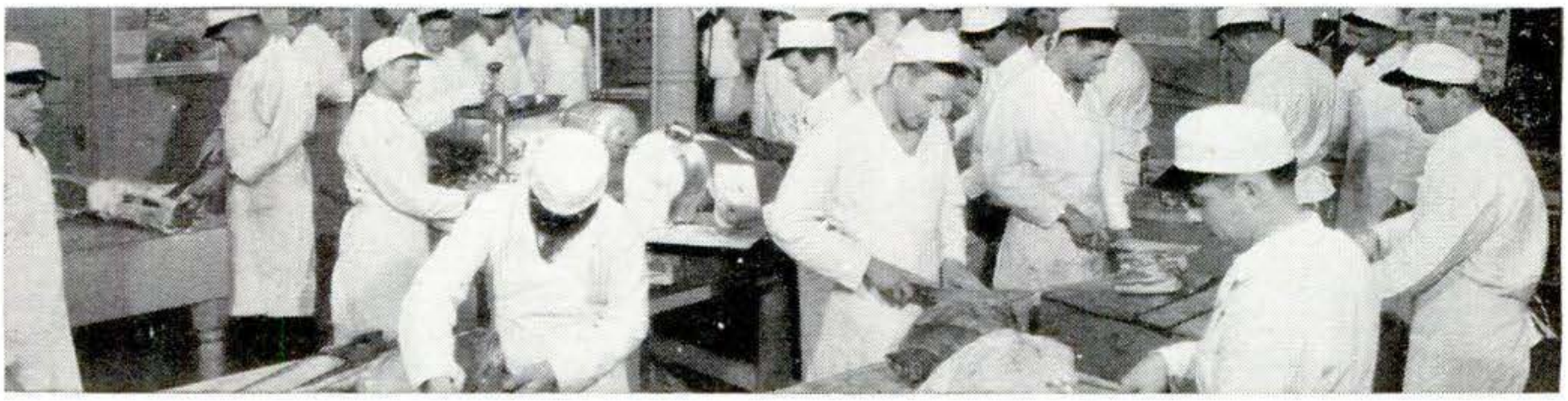

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750x16	12.50	710x15	6.50	32x6(8)	11.95	1000x22	19.50
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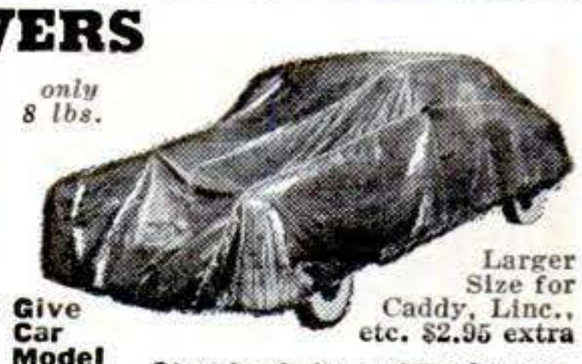

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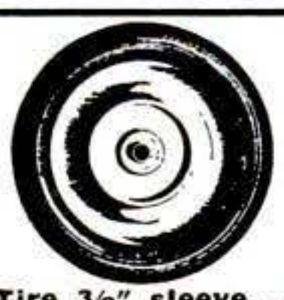

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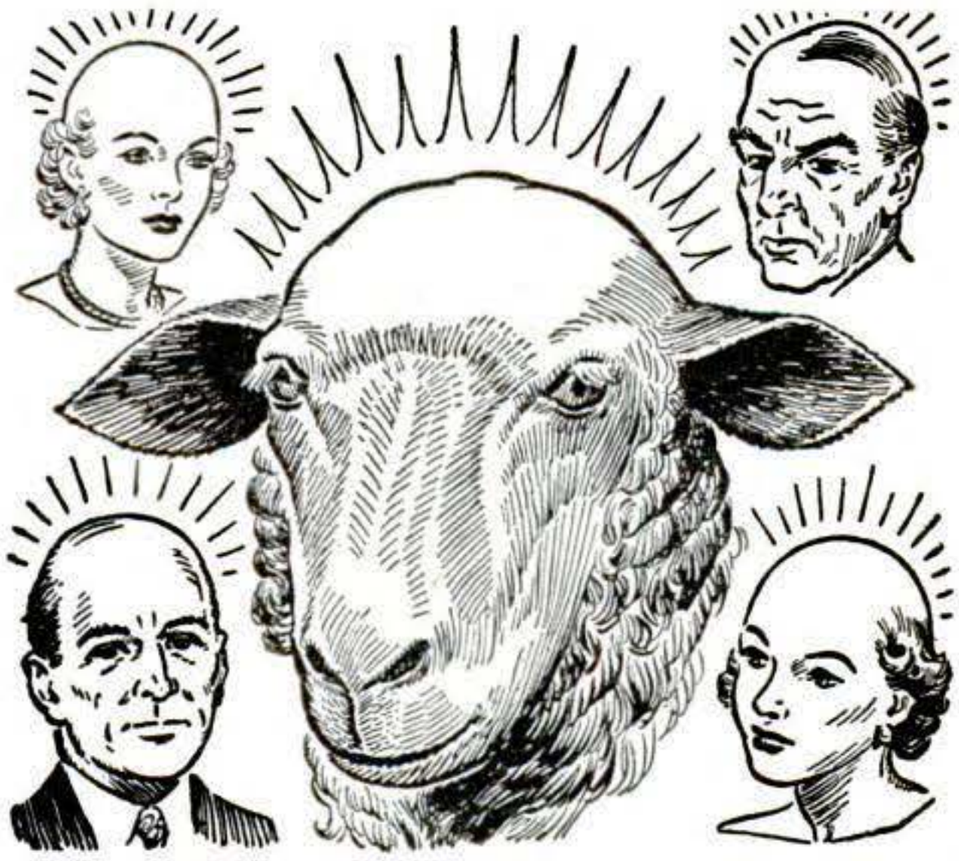

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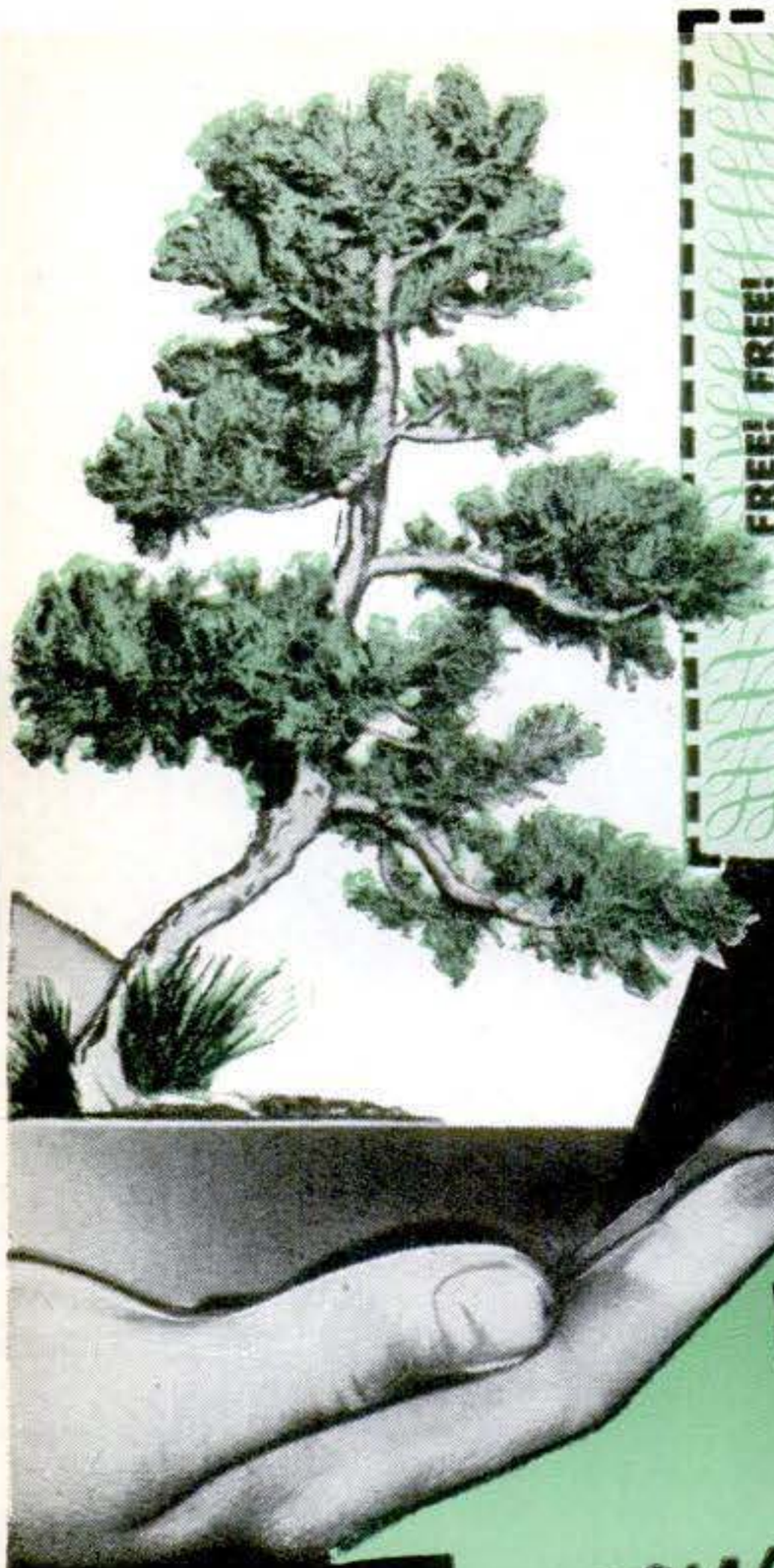

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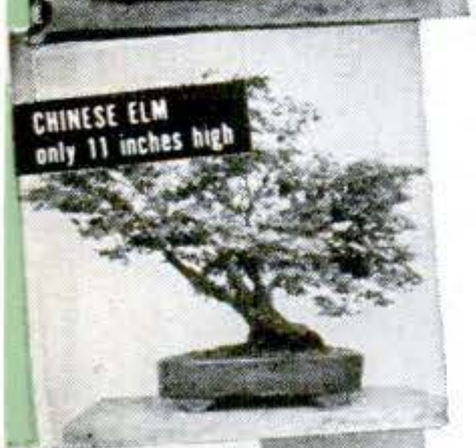

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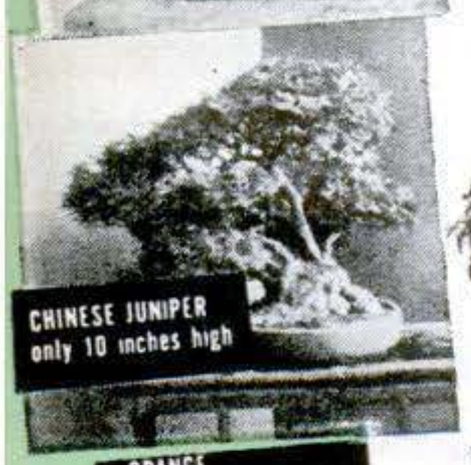

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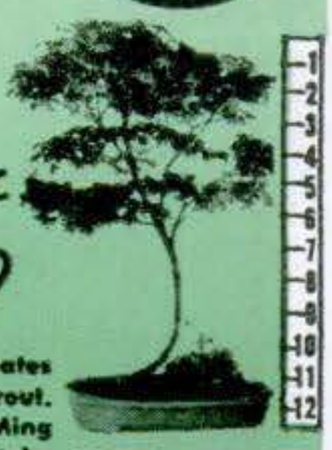

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CASH In With Newspaper Clippings. Write Milton, Box 33P, Kaweah, Calif.

YOU'RE entering mailorder the hard way if you haven't discovered the original Stationers Exchange mass-coverage method. Many possible applications. One: half the notaries being appointed nationally today receive one supplier's offer automatically—without effort from the supplier! His orders average $40 daily. Others similar. Literature free. Green's Service, 6583 Hamilton, Pittsburgh 6, Penna.

DISTRIBUTE our magazines evenings. Profitable homework. Experience unnecessary. Your name, address printed as publisher. Samples, materials, instructions, $1.00. (refundable). Wright Publications, 2276-P Hubbard, Memphis 8, Tennessee.

$$$ IN Personalized Baby Record Books. Sell By Mail Use Same Literature We Do. No-Co-Ro, Oakland 6-P, Calif.

YOU can be Notary Public. Information Free. Magnolia Press, Box 1272-S, Burbank, Calif.

ADDRESSERS Needed Immediately by national firm. Type or longhand. Everything furnished. Rush 3c stamp for information. Cosgrove, Box 4097-N, San Diego 4, California

MILLIONS For Small Businessmen. Large list, $1.00. Proven Enterprises, 334 S. Wabash, Rm. 1, Chicago 4, Ill.

WE PAY Cash for Boxtops, Labels, Wrappers, Coupons, Bottle Caps, etc!! Particulars free. Boxtops, PS-983-E Main, Columbus 5, Ohio.

JOIN "Money Getter's Guild"; get monthly magazine; money making tips; benefits; discounts. 12 months $1.00—Sample 10c. Costar, G.P.O. 972, New York 1.

SEND 25c Wholesale Gift Catalogue. Gifts, Box 2929, Odessa, Texas.

HOW to operate Income Tax Service part-time, home. Copyrighted Folio. Quarter. Professional School, 1416P/S Maile, Cleveland 7, Ohio.

MAGNETIC pot holder clings to the stove! Over 500,000 sold already. Buy wholesale, sell retail for big profit. Samples, details—$1.00. Magnex, 854 Broadway, Denver 3, Colorado.

NEED more money? Learn Advertising. Write Botts Advertising, 1211 Laura, Wichita, Kansas.

BE appointed Notary Public, your state. Thrilling experiences. Increased income. Men, women. Young, old. Write Box 3025, Dallas 2, Texas.

GET Facts—$4.00 merchandise. $2.00 treatise 100 money makers. $6.00 value $2.00. Kahn, 506 West 45th, Chicago 9.

MAILING postcards offering fast selling merchandise is very profitable. Everything furnished. Details 25c. Biglin, 49 Cove Lane, Levittown, New York.

39 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

500 MONEY Making Formulas, 25c Postpaid. Allen, Dept. PSC, Clinton, Missouri.

SALTED-In-The-Shell Peanuts. Learn this interesting and secret process from the man with over thirty years' experience. A formula of inestimable value. Send $1.00 for complete details of process and instructions to B&W Nut Co., 932 S. Wilder St., St. Paul 5, Minnesota.

OUR laboratory tested formulas and know-how put you in business. Free information, write Stark Co., Grafton, Wisc.

ANY Formula $3.00. Chemical Instruction Sheet—catalog 10c. J. Belfort, 216 W. Jackson Chicago 6.

LATEST and best in modern manufacturing formulas since 1897. Literature free! Lescomb Miller, Chemist, Tampa, Fla.

LABORATORY Tested Formulas. Catalog free. Pont Chemical Company, Terre Haute 1, Indiana.

FREE Formula Catalog. Anything analyzed $35.00. Western Chemical, Salem, Ore.

40 PLASTICS

PLEXIGLAS. Lucite. Any size sheets masked Square foot (12 x 12) cost 1/16" $1.20; ⅛" $1 40; 3/16" $1.75; ¼" $2.08. Include 10% Postage. Minimum order $3.00. Almac Plastics, 600 Broadway, N Y C.

PLASTICS home-craft course for Men and Women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for Free booklet. Interstate Training Service, Dept. D2-K, Portland 13, Oregon.

NEW liquid casting plastic. Clear, colors. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for Castolite Creations Manual and proved Success Plan showing how to make money at home. Castolite, Dept. L-102, Woodstock, Ill.

TUBING, Wholesale! For Model Airplanes, Railroads, Chemical Experiments, Etc. Send For Samples, Technical Data 25c. Hobby Vinyls, Sunbury, Ohio.

LAMINATED Plastics. Fiberglas polyester sheets 1/16" to ½" thick. Can be sawed, drilled, sanded, etc. Specialty Distributing Company, 5614 Wooster Pike, Cincinnati 27, Ohio.

PLASTIC Sheets, Rods, Tubes; etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

DIRECTORY of Manufacturers, for liquid plastics, liquid rubber, wholesale. Castleco, 2139S, Paterson, New Jersey.

FIBR-Glass Build Boats, autos, etc. Starter Kit $4.00 (Covers 11 Sq. Ft.) Free Information. Northwest Fibr-Glass Company, 1531 Morgan Avenue North, Minneapolis 11, Minnesota.

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FIBERGLAS, Polyester, Plexiglas, Acetate, Vinylite: Casting, coating plastics: My own Fiberglas "How" book now ready —$2.50. Fast service, best prices. Catalog —10c. Airmailed—35c. Gem-O'-Lite, Box 6868P, North Hollywood, California.

PLASTICS—Cements—Dyes—Findings—Carvings. Wholesale prices. 64 page catalog free. "Trace & Carve" pattern book for carving and coloring fish, birds, animals, only 35c. Taylor & Art, Inc., 1710 East 12th St., Oakland 6, California.

"INTERNAL Carving of Plastic's" illustrated manual, catalog, internally carved brooch, complete $2.00 postpaid. Plastic's, Box 1812, Salt Lake City 10, Utah.

UNUSUAL Christmas decorative materials fill our complete catalogue. Van Horn Plastics, 1905 Ingersoll, Des Moines, Iowa.

41 CHEMICALS & APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting Photo-Scales, Microscopes, Chemicals, Biological and Laboratory, Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N. Y.

SPECTROSCOPE for quick chemical analysis $3.00. Cutting Sons, Los Altos, California.

MERCURY, one ounce 50c, two 75c. Five $1.50. We pay postage. Nucleus Trading Co., 1558 Minford Place, New York City 60.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 10c. Tracey Laboratories, Evanston, Illinois.

COMPLETE Catalog, 15c. Surplus lists. Laboratory Sales, Box 161-B, Brighton, Mass.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

"CHEMISTRY Selftaught"—hundreds of experiments, 621 pages. Reduced to $2.00. Greenview, Box 61-HK, Whitestone 57, N.Y.

AMAZING New Book of Science, Experiments, Formulas and catalogue of Laboratory Supplies. Only 25c. National Scientific Co., Dept. 15, 2204 W. North Ave., Chicago 47, Illinois.

42 HELP WANTED

FOREIGN & Latin American Employment 1953 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply, application forms. Hot List Firms Hiring, $1.00 postpaid. Global Reports, Box 883-S, Hollywood 28, Calif.

ALASKA!! Last American Frontier. $1.00 brings 1953 Business Directory & Government Map, Military & Civilian Construction; Homestead & Highway facts; Mining, Aviation, Fur Farming, Grazing, Timber, Travel directions, List of firms hiring, How to apply. Alaska Opportunist, Box 92-S, Hollywood 28, Calif.

$1,000,000 FOREIGN & Domestic Construction Projects published Monthly, gives Contractor & Locale, How-When-Where to apply with application form, $1.00 postpaid. Global Reports, Box 883-PX, Hollywood 28, Calif.

FOREIGN Employment Construction Work. If interested in foreign projects with high pay, write Foreign Service Bureau, Dept. PS, Metuchen, New Jersey.

ADDRESS postcards at home. Make $50 week. Lindo, Watertown, Mass.

BE A Merchant Seaman. High Pay—World Travel. Details Free. Maritime Information, Box 451, Lafayette, Louisiana.

PORTLAND, Oregon, Employment, Opportunities, Housing Information. Glenn Livengood, Aloha, Oregon.

WORK Overseas! 269 construction projects! Fall directory of every major U.S. construction company working overseas. Most complete ever published. Includes firm name, address, job location, firms seeking men. Directory is printed, plastic-bound, 42 pages. Money back guarantee! $1 postpaid. Jobservice N-1, Box 30, Billings, Montana.

WORKSHOP of the World—Delaware Valley. Information on employment in Philadelphia, Wilmington, Camden. Send $2.00 to L. Melanson, P.O. Box 1002, Kennett Square, Penna.

SOUTHERN Florida's recent terrific, booming, expansion, has created tremendous opportunities! All Fields! Huge job list, housing information, etc., just $2! (cover cost postage-handling). Employment Service-M, Box 182, Ft. Lauderdale, Florida.

$1300.00 MONTHLY for truck drivers. $1400.00 monthly for carpenters, electricians, plumbers, mechanics. $1200.00 for clerks and laborers, over $2000.00 for superintendents. Limited hiring now being done. Full information and complete foreign listings, with current information on Spain job, $1.00. Women's listings, $1.00. Complete information on stateside projects, opportunities, living conditions, etc., and domestic listing $1.00. Specify listing. Dept. 4-J, Opportunities Unlimited, 1110 Commerce Bldg., St. Paul, Minnesota.

1,000 JOB Offers, Chicago area, $1.00. Meyers, Box 1517, Chicago 90.

GOLDEN California—Men needed. Thousands of openings. Jobs to $5,000.00 year unskilled. $8,000.00 year skilled. Act Now! Send $1.00; California Job Opportunities, Box 870-J, Los Angeles 53, California.

GIGANTIC foreign employment listings. Construction, trades, professional, clerical. Brochure tells where, how. $1.00. Global Opportunities, Box 6867, Dallas, Texas.

EMPLOYMENT SERVICES

FOREIGN Jobs. Contracts underway and soon starting in Africa, South America, Canada, England, Europe, South Pacific, Middle East, Mexico and Alaska. Send $1.00 for foreign job news, information, application forms, etc. DCS Foreign Job News, Dept. 268-NT, Bridgeport, Ill.

OVERSEAS Jobs. Big pay, transportation expenses. Clerical, professional, mechanical workers. Most all trades. Latest listings, airline, construction, manufacturing, oil, steamship companies, government agencies, many other opportunities. Up to date information on securing employment, contracts, income tax, application forms. $1.00. Overseas Jobs, Box 335-B14, Baton Rouge, La.

CONSTRUCTION Job List. Published Monthly. $1.00. Dempster's Construction Scout News, Dept. 268-NS, Bridgeport, Ill.

43 AGENTS WANTED

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 431-E North Clark, Chicago

WHERE To Buy 800,000 articles direct from manufacturers at wholesale prices. Send name, address for free outline. Glass Publishing Company, Ellwood City 8, Pa.

ABSOLUTELY Free—Sales Kit. Yours for the asking. Send postcard today requesting kit showing new line, belt buckles with your name or personal initials, cap badges, choice 3000 different emblems. Write Hook-Fast, Box 1425PS, Providence, R. I.

GOLD, Silver lacquered letters, Windows, doors, trucks. Standard sizes. Penny and up. Big profits. Samples. Atlas-E, 544 West 79th, Chicago 20.

AT Last! Something New and Sensational in Christmas Cards. Make Extra Money Fast! Show Satins, Velours, Metallics. Gets Easy Orders. Pays up to 100% Cash Profit. 30 Free Samples. With Name 50 for $1.50. Big Line. Amazing new Glo-In-The-Dark Ornaments. Personalized Matches, Stationery. Several $1.00 Boxes on Approval. Puro Greetings, 2801 Locust, Dept. 341-M, St. Louis, Mo.

START Your Own Business on credit. Your own boss 1658 of our Dealers sold $5,000 to $27,500 in 1952. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleighs, Dept. J-U-PSC, Freeport, Ill.

SALESMEN—make up to $50 in a day selling brand new item going to every type of food and beverage store, factories, laboratories, hospitals, etc. Samples Furnished. Utility Durawear, 53 West Jackson Blvd., Dept. PS-10, Chicago 4, Illinois.

MONEY For Xmas. Make at least $50 showing beautiful Elmira Christmas and All-Occasion Greeting Card Assortments—Name Imprinted Christmas Cards, Stationery, Napkins, Book Matches, Playing Cards—Gift Wraps, Books, Games, Household, Hostess Items. All unbeatable values. Make money while you make friends. No Experience Necessary—No Risk—Send No Money. Free Samples, Catalog, Bonus Plan, Display Assortments on Approval. Write Today! Elmira Greeting Card Co., Dept. C-635, Elmira, N. Y.

1954—WHOLESALE Dealer Kit on appliances, typewriters, recorders, cameras, giftware, lighting fixtures Free. Write Arrow Distributing, 154J, Nassau St., NYC.

$200 WEEKLY. New invention. Amazing 4-second Presto Emergency tire chains, fit all modern auto wheels. National advertising building big demand. 3 sales daily to oil stations, dealers, etc., make $200 or more weekly. Territory going fast. Write Presto Chain Co., Dept. P-25, Des Moines 2, Iowa.

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ANYONE Can Sell famous Hoover Uniforms for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics—nylon, dacron, orlon. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. T-101, New York 11, N. Y.

AMAZING Quick Easy Cash Yours! No selling, show Rainbow's beautiful Christmas Card assortments, gifts, personalized stationery, napkins, etc. Save friends, relatives time and money. No investment. Deal with one of New York's largest imprint companies for guaranteed satisfaction. Costs nothing to try. Write today. Samples on approval. Rainbow, Dep't D, 38 E. 1st St., New York 3, N. Y.

SELL Miracle Orlon Embroidered Work Uniforms: Looks, feels, tailors like wool; wears 3 times longer. Outwears cotton 5 to 1. Acid-proof, grease-resistant. Washes perfectly pressed. Amazing profits. Outfit Free. Topps, Dept. R-5410, Rochester, Ind.

BUY Wholesale thousands nationally advertised products at big discounts. Free "Wholesale Plan." American Buyers, 629-S Linden, Buffalo, New York.

SENSATIONAL Bargains—Profits! Suits $1.75, Pants 35c, Dresses 20c, Shoes 20c. Operate from store, home, car. Free catalog. Superior, 1250-B Jefferson, Chicago 7.

BIG Money making opportunity. Exclusive line work uniforms, Jackets, pants, shirts, coveralls. Advertising embroidered. Every business prospect. Outfit Free. Master Div., Dept. 723, Ligonier, Indiana.

SCHOOL Seniors—Earn sensational profits selling classmates America's most beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft, Dept. P, 1509 Maple Street, Scranton 5, Pa.

MAKE Christmas Money At Home . . . Take renewals and subscriptions for all magazines. Big Christmas profits now. Liberal Commissions. Everything furnished. Free Catalog. Write McGregor Magazine Agency, Dept. 510A, Mount Morris, Illinois.

AGENTS—Show America's leading Nationally Advertised line—Novelties, Gifts, Utility Items. 100% Profits. Prospects Everywhere. Steady Repeats. Write today for sensational low prices, free literature. Charms & Cain, 407-PS-103 South Dearborn, Chicago 5, Illinois.

ADDRESS postcards at home. Make $50 week. Lindo, Watertown, Mass.

IS $210 a week worth a postcard to you? Then rush card with name and address for special Free Trial Plan that sells amazing new Automatic Refrigerator Defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. G-103, 173 W. Madison, Chicago 2, Ill.

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STRIKE It Rich with flannel backs. Scientific table-cover marvel not plastic, not linen, better than either. Outlasts 16 years scrubbings. Show free samples. Styleco, Dept. 407, Cincinnati 10, Ohio.

3 FOODBAGS Free just for examining America's finest plastics. Over 200 fast-selling household items—dishware, drapes, giftwares. Take orders, earn big money. Catalog Free. Loraine, 846-K Adams, Chicago 7, Illinois.

CASH In on tremendous Demand for new low priced burglar alarm for cars, homes and farm buildings. Everybody wants one. 286% profit. Unique sample offer. Northwest Electric Co., PS10, Pukwana, South Dakota.

SHOW Friends "Lifelike" Christmas, All Occasion, children's greeting cards, wrappings, gold imprinted items. Big profits. New type Bonus-Premium Reward. Write for Feature samples on approval, free samples Name Imprinted Christmas Cards, exclusive Stationery, free color illustrated Catalog. Selling Guide. New England Art Publishers, North Abington 1033-B, Mass.

AMERICA'S Newest Money-Maker! Amazing invention. Flexi-King automatic sponge mop, selling like wildfire. Pays you up to $6.50 profit. New self-wringer. 10-Year Guarantee, many new exclusive features. Get Starter Kit Free! Flexy, Dept. 411, New Holstein, Wisc.

"FOG-Stop" Windshield Cloth. Instantly removes blurry Mist, Frost, Sleet, Snow. Stops windshield fogging. Samples sent on trial. Kristee 124, Akron, Ohio.

CALENDARS, Advertising Novelties, Matches. All styles, including Religious. Varnished, 12 sheet, Girls, Hundreds of Advertising Novelties, Book Matches, etc. Fleming Calendar Co., Promotional Division, 6539 Cottage Grove, Chicago 37, Ill.

MAN to earn $150 and up per week. Long needed invention. Advertised worldwide. Prospects are everywhere. Full or part time. Exclusive. No investment. Free samples. Write Red Comet, Inc., Dept. 332-G, Littleton, Colorado.

BUY Wholesale—25,000 items—Catalog 25c. Matthews, 1472-A1 Broadway, New York City 36.

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FREE Nylons! Men and women wanted to introduce amazing nylon stockings (guaranteed against runs and snags) by giving away free trial pair to every woman regardless whether or not final purchase is made! Earn up to $3 an hour spare time. Advance cash plus 40% bonus. Postcard brings you Free sample stocking and money-making outfits. Nothing to pay now or later. No obligation. Kendex, Babylon 54, New York.

101 WAYS To Make $1,000 At Home. Details free. Business Surveys, 365 So. Fairfax, Los Angeles 50, California.

CALIFORNIA sweet smelling beads, sensational sellers. Particulars free. Mission, 2328P West Pico, Los Angeles 6, Calif.

BIG profits selling ties ($2.00 values) $6.50 dozen. Free catalog. Empire Cravats, 611 Broadway, New York 12.

BUY wholesale and save 50% on big name merchandise. Xmas Gifts. Make big profits selling your friends or for your own use. Our 1953 Catalog is ready. Rake, 607 Spring Garden, Philadelphia 23, Pa.

EARN $50 Weekly Spare Time. Sell Vitamins. Emm-Bee, Box 992, New York 8, New York.

EASY handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

MEN, Women, Make Money Spare Time plus New Car as Bonus for Encouragement. Amazing hosiery Guaranteed to wear without holes, snags, and runs, or replaced Free. For example, lovely 60 gauge nylons Guaranteed for as long as 1¼ years, or replaced Free. Write Wilknit, 20310 Wash., Greenfield, Ohio.

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WOULD You Like To Begin Selling Advertising Specialties? Get the facts on steady and guaranteed income for Life! Raff Company, Box 29, Berwyn, Illinois.

SELL new clothing. Lowest Prices. Operate from home, auto, store. Enormous Profits. Big Catalog Free. S&N, 605-C 12th Place, Chicago 7.

NAME Brand Merchandise Start your own business using our stock. Send 25c for large catalog. McKittrick Distributing Co., Box 27, Aurora, Colorado.

FREE book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-38C, Oceanside, Calif.

MEXICAN Feather Pictures. Sell on sight; 200% profit! Free details. Sample 20c stamps. (No Coins). Sylvias, Apartado 9036, Mexico City.

PAY Way! Wood-chain saw. Rotohoe. (Also, TV Unit). Earn Yours! Farmco-52, Excelsior Springs, Mo.

SEND 25c for Wholesale Gift Catalogue. Box 2929, Odessa, Texas.

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MAKE Extra Money. Sell front door name plates to friends, neighbors. Retail $1.98—you make $1.00! Free selling kit. Modern Engraving Co., P.O. Box 194, Boston 14, Mass.

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$1.00 PROFIT selling $2.95 photo enlargement offer Allen Studio, Riegler Bldg., Little Rock, Arkansas.

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$50 DAILY Selling Sensational Atomic wonder polish. Shines cars quickly. Details Free. 3 car can $1. Star Dust, 405 Madison, Fort Wayne, Indiana.

BIGGEST profits. "New All-Purpose Silver Plating Polish". (Cloth rub-on.) NuSilver, 508-PS10, Aurora, Illinois.

SENSATIONAL new plan! Large wholesaler appliances, cameras, watches, etc. Will start you in new type of business. No selling! Free details! Cam Company, 6806PS-20th Avenue, Brooklyn 4, N. Y.

44 HIGH-GRADE SALESMEN

ADVERTISING book matches—Cash in on big demand—sell Union label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-1053, 7530 Greenwood, Chicago.

AD Matches! Sell Amazing Designs—20, 30, 40 and 240-light book matches. Biggest spot cash commission; every business a prospect. Low prices for high quality Repeats. Start without experience; men, women; full, part time. Buy Nothing! Sales kit furnished. Match Corp., Dept. PS-46, Chicago 32, Illinois.

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SELL Business Men Holiday Greetings. Details. Robinson, 269-R Liberty, Paterson 2, New Jersey.

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SLIDE Rule with Free 28-page instruction book. Multiplying, proportion, division, roots, etc. A, B, C, D, C1, and K scales. Everyone can use. Full 10". Special 92c plus 8c postage. Gene R. Loewy, 545 Fifth Avenue, New York 17.

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YOU can win success if you desire it. 50 inspiring books on self-improvement. Also records that heal. Send for Free list. 50 success formulas with every order Free if you ask for them. C. Rey, Box 589, Loring Station, Minneapolis, Minnesota.

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BE a draftsman. Complete course at once. Best for your money. Write for details. General Products Co., 3636-17th Ave., South, Minneapolis 7, Minn.

STRUCTURAL Drafting. Drawing outfit furnished. Roth Technical Institute, Box 2283, Youngstown, Ohio.

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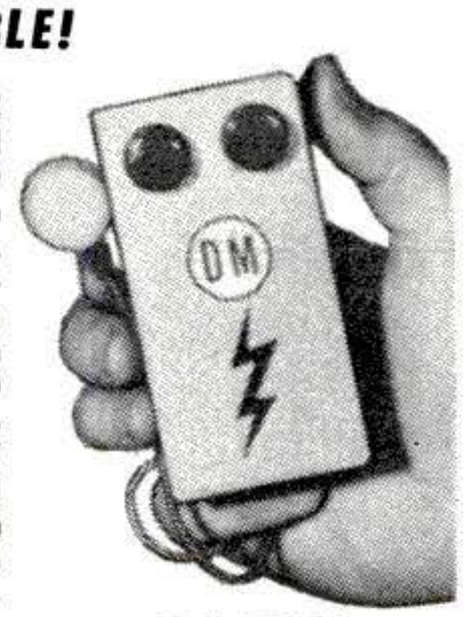

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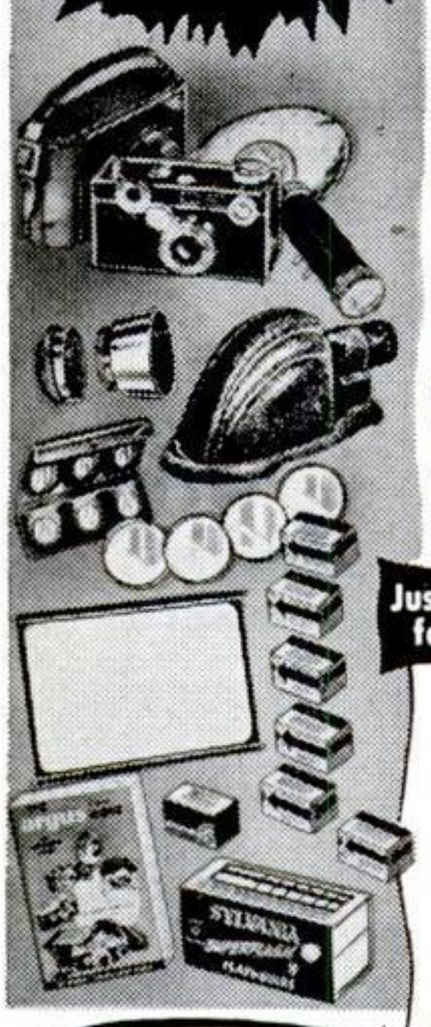

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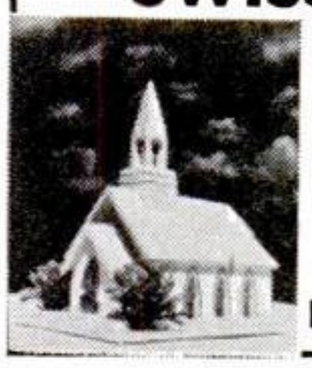

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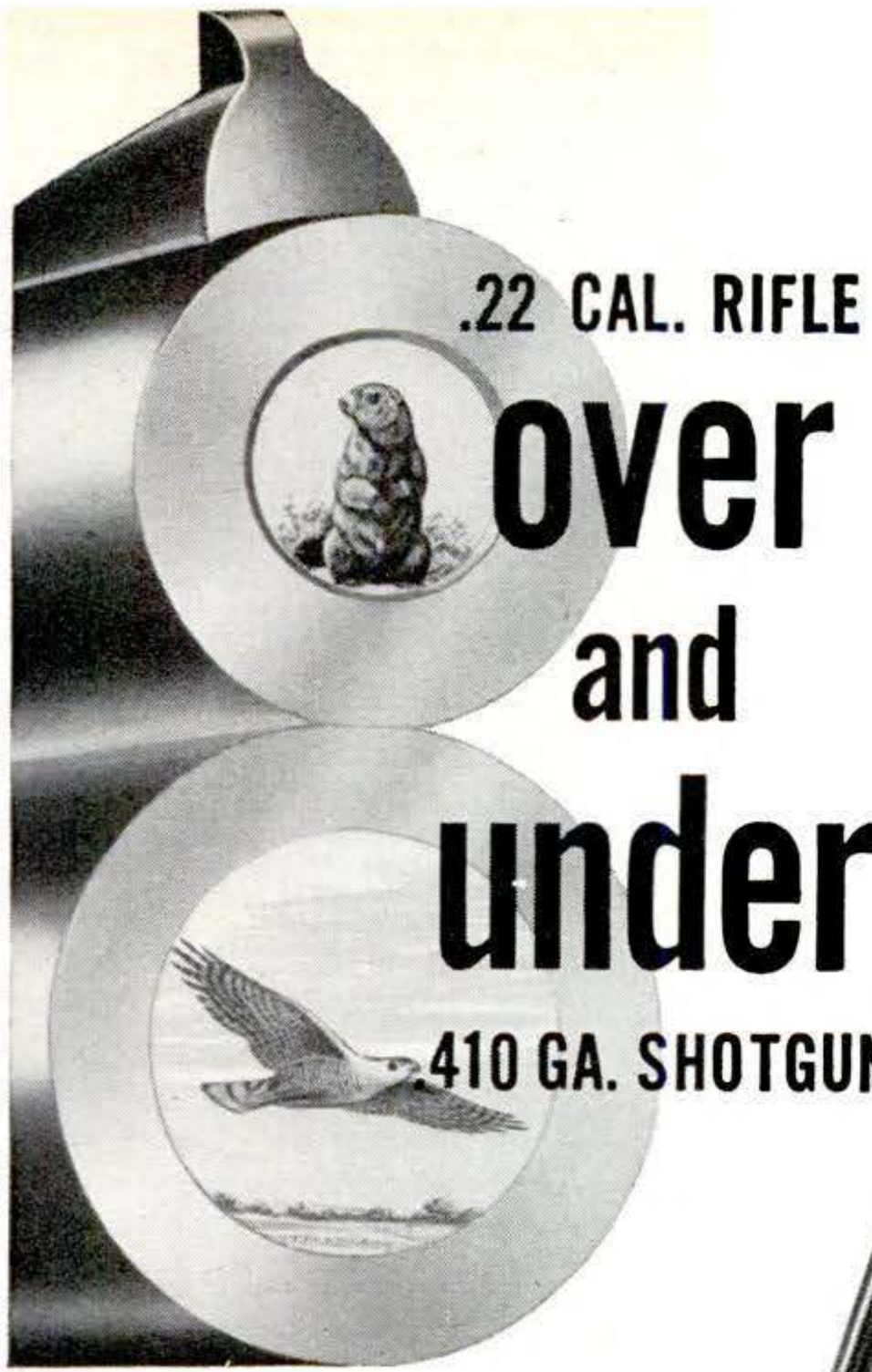

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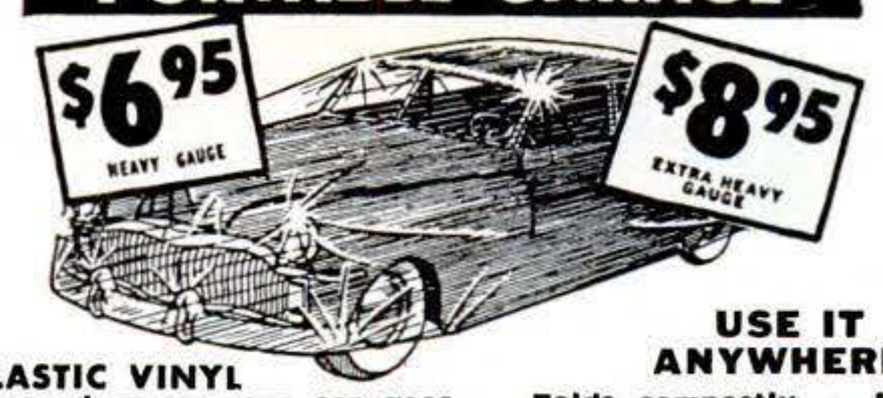

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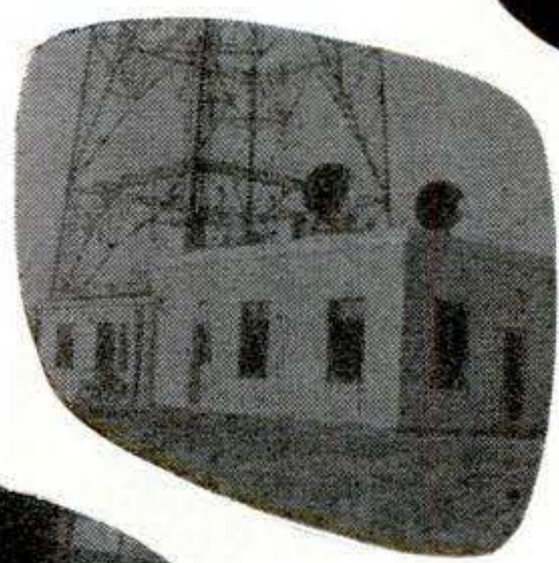

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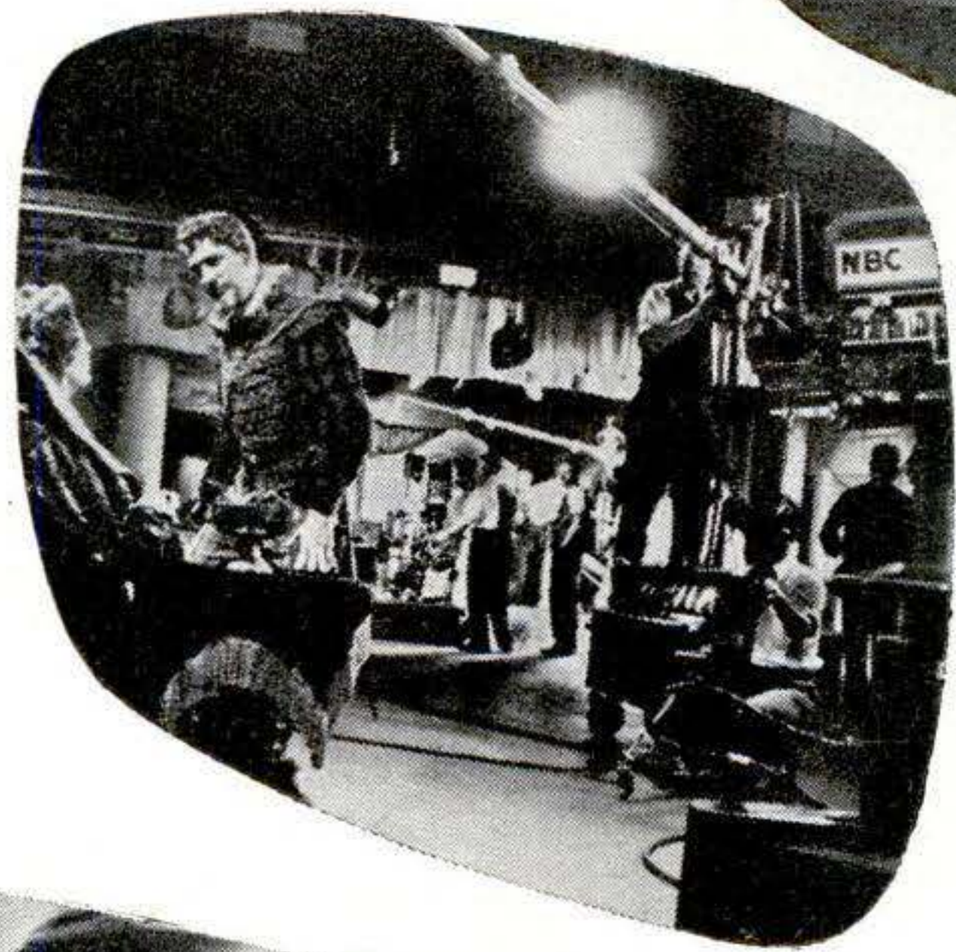

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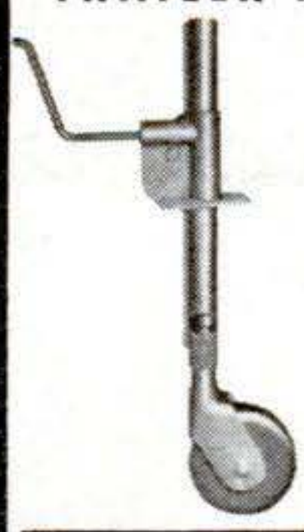

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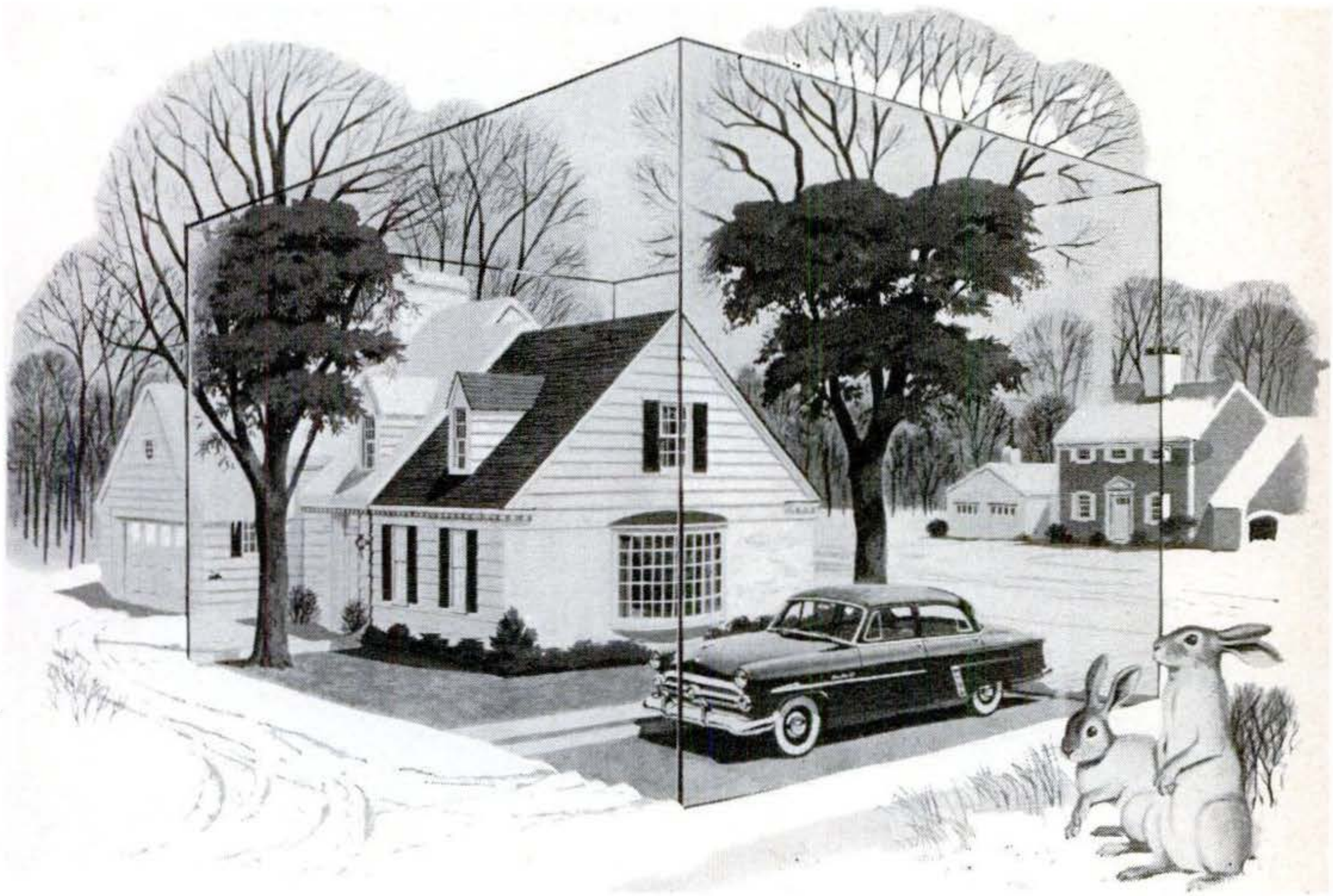

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POPULAR SCIENCE
REG. U. S. PAT. OFF. Monthly

Can a Water Witch Really Find Water?

Sometimes—if he knows enough about his own countryside, says this eminent geologist. But today's needs demand the scientist's surer skills.

By Howard A. Meyerhoff

Bygone water witches are matched by 20th century dowsers like Henry Gross.

THE only thing worse than a dowser, in the geologists' book, is a fellow earth scientist who dares harbor a lingering doubt that dowsing is completely ridiculous. Find water by walking over the ground with a forked stick in your hands? Absurd superstition!

There is a good reason for this attitude. Although many modern sciences were born of superstitions and myths, the pseudo sciences have died out. Alchemy, for example, has given way to chemistry. But dowsing, one of geology's ancestors, still has followers both among historical novelists and hard-headed farmers.

Early in my geological career, I found my scientific reputation and integrity in jeopardy over dowsing. I was making a survey in Puerto Rico. Water for locomotives was needed at the end of a narrow-gauge cane railroad. So Walter Schlecht, an engineer for the Cambalache Sugar Central, and I went to see if we could locate a source.

The ride took us up a heavy grade, out of the Rio Arecibo Valley, and thence across a rolling limestone plateau. Deep hollows, or sinkholes, were numerous as we neared the end of the line. The maze of sinks indicated a network of caverns beneath. In such a country, water disappears from the surface as if it were a sieve; it flows underground in narrow channels that wind through rocks in all directions. You

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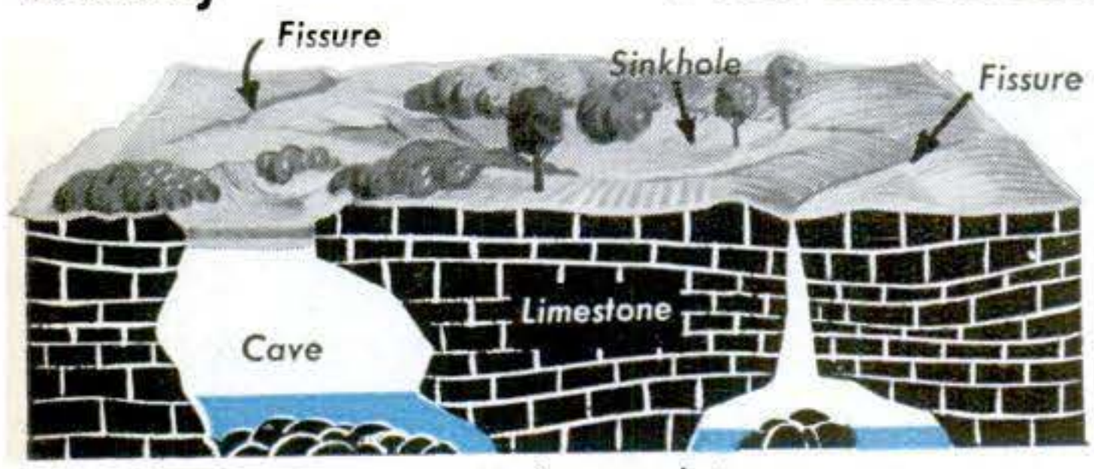
have to be lucky to locate and tap water from the surface.

"Well," said Schlecht, "if science can't do it, maybe a divining rod can."

He cut two forked sticks and, with about as much self-assurance as two small boys raiding a cookie jar, we started out. I hadn't gone 40 feet when the end of my stick started to curve downward. I stopped; it stopped. I moved on, and it bent straight down. The pull was so powerful that the wood fibers broke.

Limestone Country



Underground stream

Water flows underground where there is channel for it to flow, or out of rock. Here, an Illinois sinkhole indicates a cave

I yelled at Schlecht, who came witching his way toward me. About seven feet from me, his rod went through the same antics.

Rod Comes Close

Several weeks later, when I saw Schlecht again, I asked what he had done about water.

"Oh, we got it—at that place six kilometers from the end of the line where you said we might. You missed the depth by only a foot or two."

"You mean you didn't drill where we dowsed?"

"You don't think I believe in that stuff enough to bet 6,000 bucks on it, do you?" he retorted.

For 27 years, I've wished that Walter Schlecht *had* bet $6,000 on that divining-rod location. Like Schlecht, I don't believe in it—but those doggone sticks did turn down!

That's why I appreciate it when a responsible scientist discusses the subject seriously and objectively, as Evon Z. Vogt did in *The Scientific Monthly* in September, 1952. He reported one of the few statistical efforts to show that science applied to the discovery of water pays off: 83.9 percent of the wells drilled without benefit of dowsing in New South Wales produced 100 gallons or more per hour, and 7.5 percent were failures; whereas only 70.4 percent of the dowsers' wells yielded 100 gallons or more per hour, and 15 percent were failures.

But Vogt recognized that dowsing is a practice widely used, and something more than a poor joke. The traditional explanation of it is that the cut twig has an affinity for water and bends toward it. No scientist will buy this idea.

Dowsing is regarded by most scientists as either a psychological phenomenon or simple sleight of hand. Some hold that the dowser is so well versed by experience in the lay of the land that he knows, consciously or subconsciously, where to localize his search and manipulates his stick, deliberately or unconsciously, at a likely site.

Both as a practicing geologist and as a part-time New England countryman, I've seen enough of dowsing to know that every dowser has a vast store of rule-of-thumb knowl-

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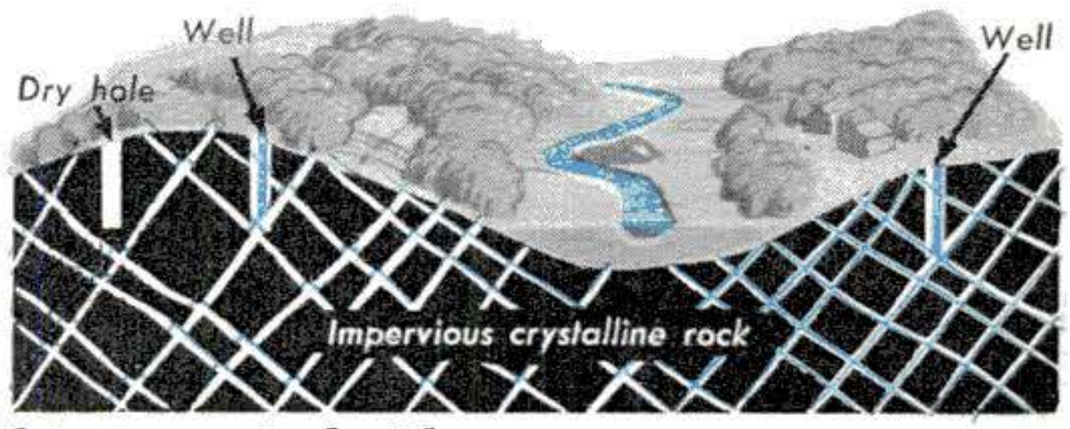
edge about ground water. Most of them are old-timers who have dealt with the problems of domestic water supply—and solved them.

Regardless of the divining rod's role, or how good an act the dowser puts on, however, water underground obeys physical and mechanical laws. All ground water comes from the surface. How much goes underground depends on local conditions.

If the soil is porous and permeable, like the sand of a beach or the gravel of a riverbank, a third or more of the water will sink into the ground, filtering downward until it reaches a level where the soil is saturated. If an entire valley bottom or a large land surface, like much of Long Island, is floored with sand or gravel, there is water at every point beneath, and even a duffer can locate water as successfully as a dowser.

Solid Rock



Water enters only through cracks. Best chance for well is to hit where two meet.

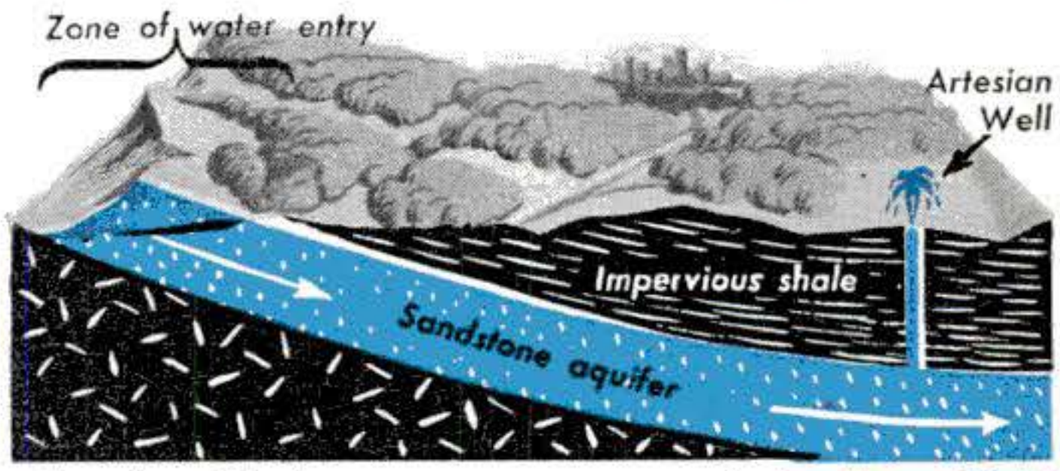
Finding a suitable site for a well is much more tricky in country where solid rock lies at shallow depths below the soil, or where there are broad expanses of clay that resists the entry of rainwater. In such country, if it is at all hilly, most of the rain runs off.

Clay deposits, however, although they may be broad, are generally limited in thickness, and an "aquifer"—a porous, water-bearing sand or gravel—usually lies beneath them. Finding water in such a situation merely involves penetrating the barren or dry clay and tapping the aquifer.

Here is where geology can outpoint dowsing. Careful examination of local rocks and soil nearly always will provide enough information as to the existence of a deep, water-producing layer.

The Western plains are underlaid by alternating layers of rocks. Some of these are excellent water carriers, others are dry as a bone. These layers form broad domes and basins, and in the domes the aquifers come to the surface and pick up supplies of surface water. Gravity forces the water to travel slowly downward away from the domes and into the basins.

Rain drains down layer of water-carrying rocks, gushes forth when tapped miles away.



Artesian Well Country

Artesian Supply Remote from Rain

Here it may yield an artesian supply remote from the hills where the rain fell. In the Dakotas, rain that drenches the Black Hills eventually filters its way scores of miles eastward in the so-called Dakota Sandstone, to be drawn under a head of pressure in artesian wells in Great Plains localities where rain and surface water supplies are erratic.

The Pecos Valley around Roswell, New Mexico, is another region famous for its artesian water. In such areas every rancher knows that the aquifer forms a thick layer under every acre of his ranch, and if he wants water he is more likely to consult a banker than a dowser. Artesian water is

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WATER POURS OUT of artesian wellhead in Roswell Basin, New Mexico. No pumping is needed as water is pushed up pipe by pressure in tilted layer of water-carrying rock far below.

usually deep, and drilling is expensive. But the rancher can take comfort in the fact that he can't miss— unless the driller is so inept as to seal off the water by failing to keep rock dust flushed out when the drill reaches the water-bearing layer.

In addition to working with complete assurance, the driller knows the drilling depths with such precision that costs can be computed to the nearest hundred dollars. So there's business for the banker and the driller in tapping artesian water, but none for the dowser.

Solid rock offers the water seeker an intricate set of problems, because rocks vary in type, structure, porosity and permeability. In some, like the granites of the White Mountains and Sierra Nevada, or the crystalline schists and gneisses of New York City and the Piedmont, water can enter only in cracks and fissures. Here the location of a well site depends either on luck or on careful calculations designed to hit a fissure or fracture system large and open enough to support an adequate flow of water. This is the kind of country in which dowsers thrive.

ELECTRICAL-RESISTIVITY apparatus is an important tool of the scientific water hunter. Above, it is being used to locate a contact point between fresh and salt water in Florida.

But here, too, the systematic analysis of the fracture system and the use of directional drilling so as to assure the penetration of water-bearing fractures are sure to pay off, because the cost of drilling is high and the loss from failure can be ruinous.

Nevertheless, on the small scale on which a dowser operates, he may be successful enough to build up a following. Such success may go to a dowser's head. Some water witches assert that they can predict the approximate amount of flow that can be expected in a chosen location.

If they are old-timers with many wells to their credit, I daresay they can often hit it very close.

The yield of any well can be tested by pumping. If, after pumping at a measured rate, the water level remains un-

[Continued on page 304]

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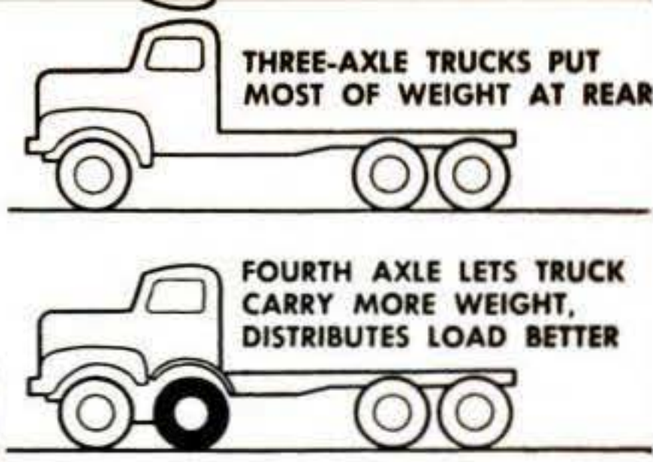

Second Front Axle Lets Trucks Carry a Bigger Payload

BECAUSE truck loads are limited by law to a certain number of pounds per axle, lots of trucks carry twin rear axles. Now a new dual-steering tandem front axle will let truckers boost payload even more. Two walking beams and a few steering rods connect the second axle to the regular front axle. Four rubber cushions in metal cylinders serve as shock absorbers and each of the four wheels has its own brakes.

Invented by a Pennsylvanian, the system was further developed by the Chain Belt Co., Milwaukee. They say the four wheels give better traction in steering, offer less tendency for the front end to become stuck in mud and cut down jar transmission.

Transistors Built Under Glass

WORKING with tweezers and peering like Popeye through an illuminated magnifying glass, this young lady is mounting hair-fine wires on a speck of germanium for assembly in a tiny transistor. The photograph was shot from beneath an all-glass table at the RCA plant in Harrison, N. J.

Airman Turns to Scooters

LATEST number to come off the drawing board of Ernst Heinkel, German aircraft designer, is the little motor scooter above. A four-cycle, air-cooled engine pushes it along at 54 miles an hour. Heinkel, shown ready for a spin with his young son, says it can do 60 miles on half a gallon of gas.

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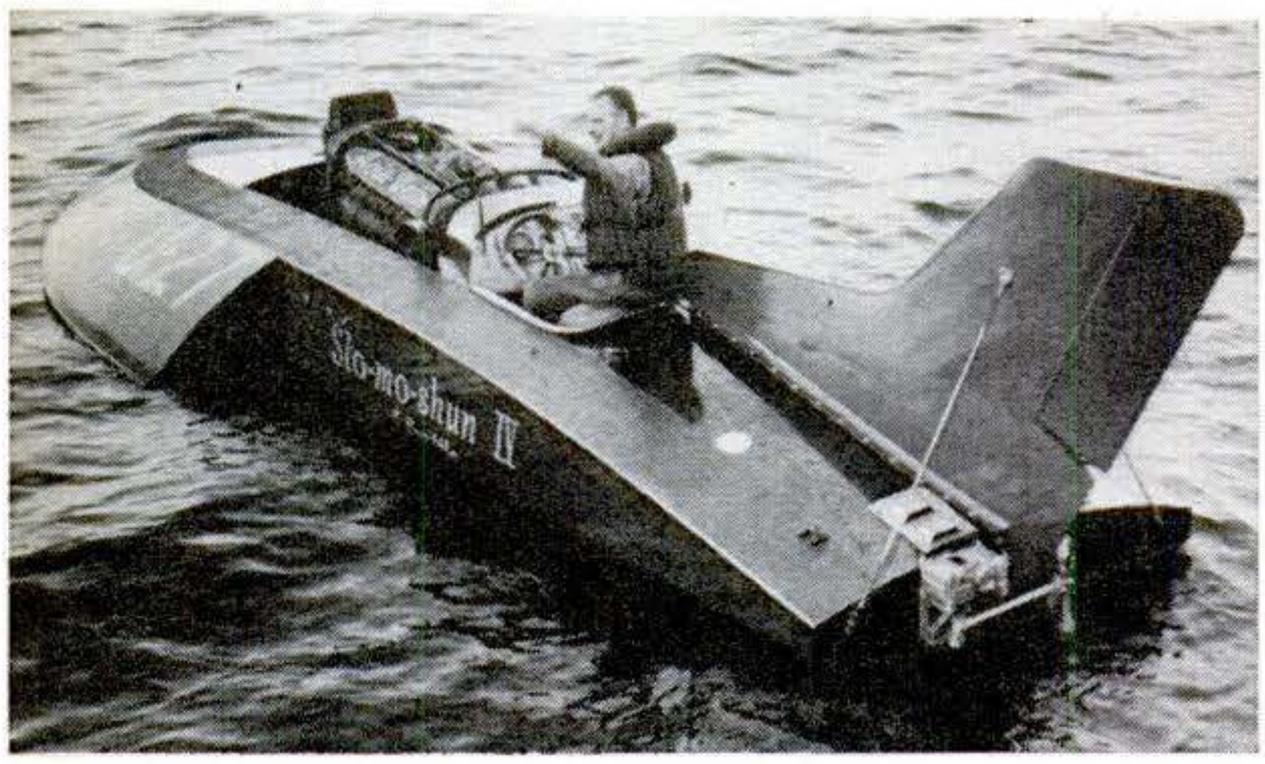
Aging Slo-mo-shun IV clinches title of World's



SLO-MO-SHUN IV, **Queen of the Gold Cuppers, returns to dock after her third victory in four starts. Joe Taggert is at the wheel. At right, *Slo-mo* flashes past the judges' barge to salute the crowd after winning a heat of the 90-mile race. Times of the various entries are being chalked up on blackboard in foreground.**

NAVY BLIMP SOARS overhead as a Gold Cupper roars over course, her "rooster tail" of spray astern. One lap is 3¾ miles, eight laps make one heat. Race has three heats, boats are scored on points.

OWNER Stanley Sayres maps strategy with his two drivers. At left is Joe Taggert, who won first and third heats; at right, Lou Fageol, who won second. *Slo-mo V*, which Fageol was to race, broke down.

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Greatest Speedboat

POWER sailors call her the greatest racing boat ever built: a flying platter named *Slo-mo-shun IV* that has skimmed to victory in the World Series of motorboating in three of the last four years. She also holds the world's straightaway record of 187.6 m.p.h.

In her third victory in the American Power Boat Association's Gold Cup race, on Lake Washington near Seattle, the hydroplane last summer beat the field of five newer boats and set a new 30-mile heat record of 95.268 m.p.h. Her average for the race—90 miles of hairpin turns—was better than 90 m.p.h. In fact ol' *Slo-mo* made a perfect score of 2,000 points —400 for winning each heat, 400 for the fastest heat, and 400 more for the best race.

The old lady—built in 1949, she is old by Gold Cup standards—is 4,000 pounds of mahogany and oak, her stress areas

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sheathed with tough 24-ST aluminum plates. Her single-blower, 1,700-hp. Allison turns her prop 9,000 revolutions at full speed, and only 36 square inches of hull touch the water as she planes on three small areas. Her rudder is moved hydraulically through an offset box: the "air rudders," or trim tabs, are fixed and take care of torque.

Slo-mo was designed by Ted Jones, a former Boeing supervisor, and engineers from the Boeing company give her aircraft-type maintenance. This past winter her speed was boosted with a new swept-back tail, designed by Jack Harschman, a guided-missiles expert.

Months' Build-up for Hour's Run

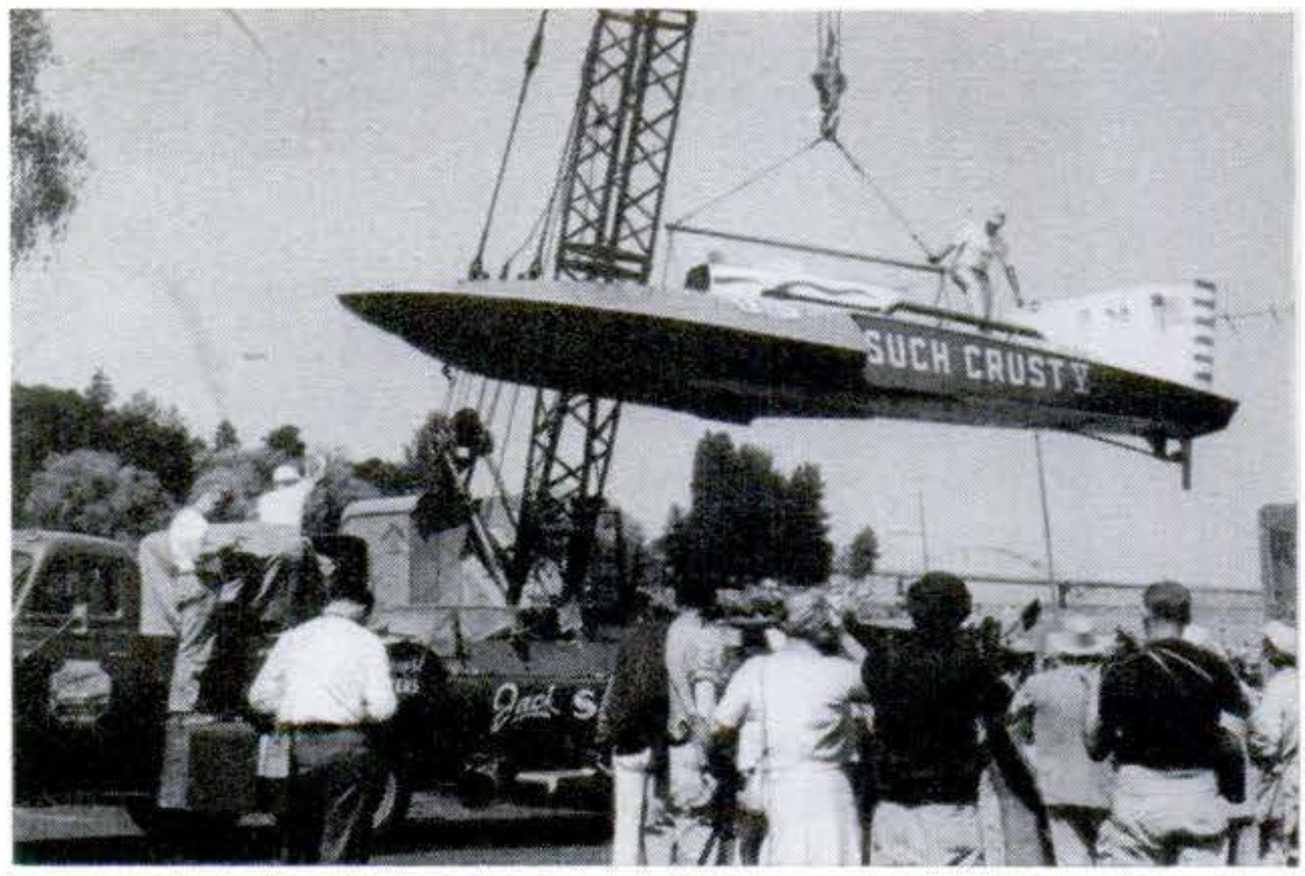
It took *Slo-mo* less than an hour's fast running to win the Gold Cup for owner Stanley S. Sayres—but it cost him months of preparation and nobody knows just how many thousands of dollars. An individual boat of the Gold Cup class (unlimited hydroplanes) costs $12,500—up. A single entry may have $5,000 worth of props in assorted sizes and pitches. Engines are usually used Allisons, considered war surplus, but this year the winner's sister boat, *Slo-mo-shun V*, had a Packard-built Rolls-Royce Merlin.

For the competitors who must bring their boats from a distance—this year Sayres was the only one on home waters—you can tack on the cost of a trailer and a truck.

Partly because of this travel expense, the other competitors are hopeful that after next year the Gold Cup race may be held away from Seattle. Another reason is that they feel at a disadvantage by not being able to have a long advance tune-up on the placid waters of Lake Washington.

Even without travel costs, a top competitor finds this is a rich man's game. Sayres, a Seattle auto dealer, says that he can't afford to keep his two crack boats in competition. But he daren't sell them to an Easterner. Seattle, which at first resented their loud roaring across its placid lake, wouldn't let him. END

Slo-mo-shun's Rivals



SUCH CRUST V, owned by a baker, came all the way from Detroit to finish last. Sister boat *Such Crust III*, however, biggest boat in race, did better, finished in third place.

GALE II, seen bow-on in the water, was second in race. Her 24-year-old owner-driver had raced only five times, is considered a comer. His father built the boat and gave it to him.

MISS UNITED STATES and five other boats rode trailers from Detroit to Lake Washington. *Miss U. S.* was brand-new, needed more tuning, did not start last heat, finished fourth.

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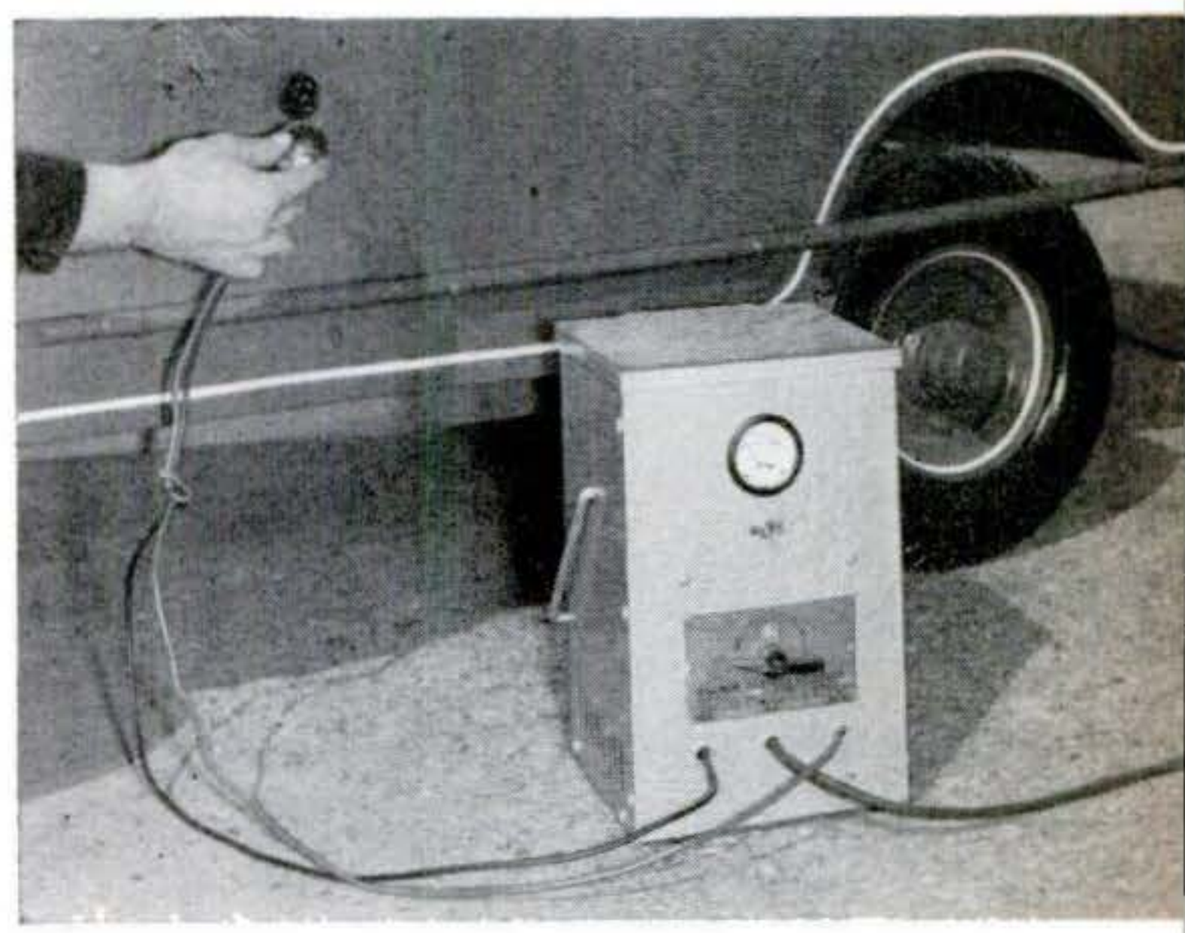
35 Miles for Three Cents

For three cents a day, the maker claims, you can ride all around town in this battery-operated, three-wheeled car big enough for two. At night you hook a charger that comes with the Autoette into any electrical outlet in the house. Next morning you're ready to roll for 35 miles or play 27 holes of golf with no walking.

The heavy-duty batteries provide enough juice to run 12 miles an hour. The car has three forward speeds and a reverse. An automotive-type internal expanding brake does the stopping when it clamps down on the drive shaft. Full spring suspension and pneumatic tires cushion the ride. The Autoette is made at Long Beach, Calif.



Armadillo Suit Protects Soldier from Mine Fragments

The soldier at right is armored like an armadillo to protect him while searching out buried mines along a Korean road. The top of the 24-pound suit is a modified armored vest. The trousers are Army regulation with laminated nylon plates attached.

▶▶▶Latest way to check on whether insects are eating stored grain is to listen for them. Kansas State scientists place kernels with a mike in a soundproof box. The sound of the movement and feeding of larvae or pupae in the kernels is picked up and amplified through a speaker.

New Skyscraper's Aluminum Skin Put On in One Week

THIS gleaming, 26-story building on New York's Park Avenue is sheathed in aluminum. And putting up the prefabricated walls and window panels of the self-cleaning metal—1,800 of them, each two stories high but weighing only 100 pounds—took only six and a half days. They were bolted to the framework at a rate of three a minute. General Bronze Corp. workmen did the job from inside without exterior scaffolding.

They Say Now.....

JAMES C. MALIN, PROFESSOR OF HISTORY, UNIVERSITY OF KANSAS: *"The first requisite of a natural resource is an idea. There are no known limits, therefore, to the multiplication of natural resources of the earth, and exhaustion of them is impossible, except, or unless, the capacities of man are exhausted . . ."*

DR. EVAN J. CRANE, EDITOR, CHEMICAL ABSTRACTS: *"A dictator can often be very efficient in working for a specific purpose, but where science is concerned, dictation is futile and deadly . . . Science does not thrive under restrictions."*

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Electronic Magic Lets TV Star Drop in Anywhere for a Chat

You can visit famous people in their own homes with Edward R. Murrow on a new CBS show starting this month. It will be done live—no movies—even though Murrow will always be in New York while his hosts will be at home anywhere in the country.

Murrow will start by telephoning his host, while his host's home will be seen through a library window (above). For the interview, the image of Murrow will be mixed electronically with the picture of the host in his house so that the two appear to be talking face to face (left). They will hear each other by telephone.

Training Sub to Turn on Dime, Leave a Nickel Change

THE vessel sliding into the water at right, is the Navy's newest submarine—but she'd probably look more familiar to old Simon Lake than to World War II submariners. For the T-1 is only 113 feet long, the smallest submarine we've built in 40 years, less than half the size of our standard underwater craft. And she's the first single-screw sub we've built since 1909.

The T in her name stands for training, but it could just as well stand for target. With her short, stubby body, her job is to twist and turn under water while anti-submarine craft on the surface track her down for practice. But there's a chance that the T-1 may be the prototype of a new combat class. If she proves maneuverable enough she might be able to attack surface ships and evade counterattack. That's why the two officers and dozen men of her crew will have a single torpedo tube to man.

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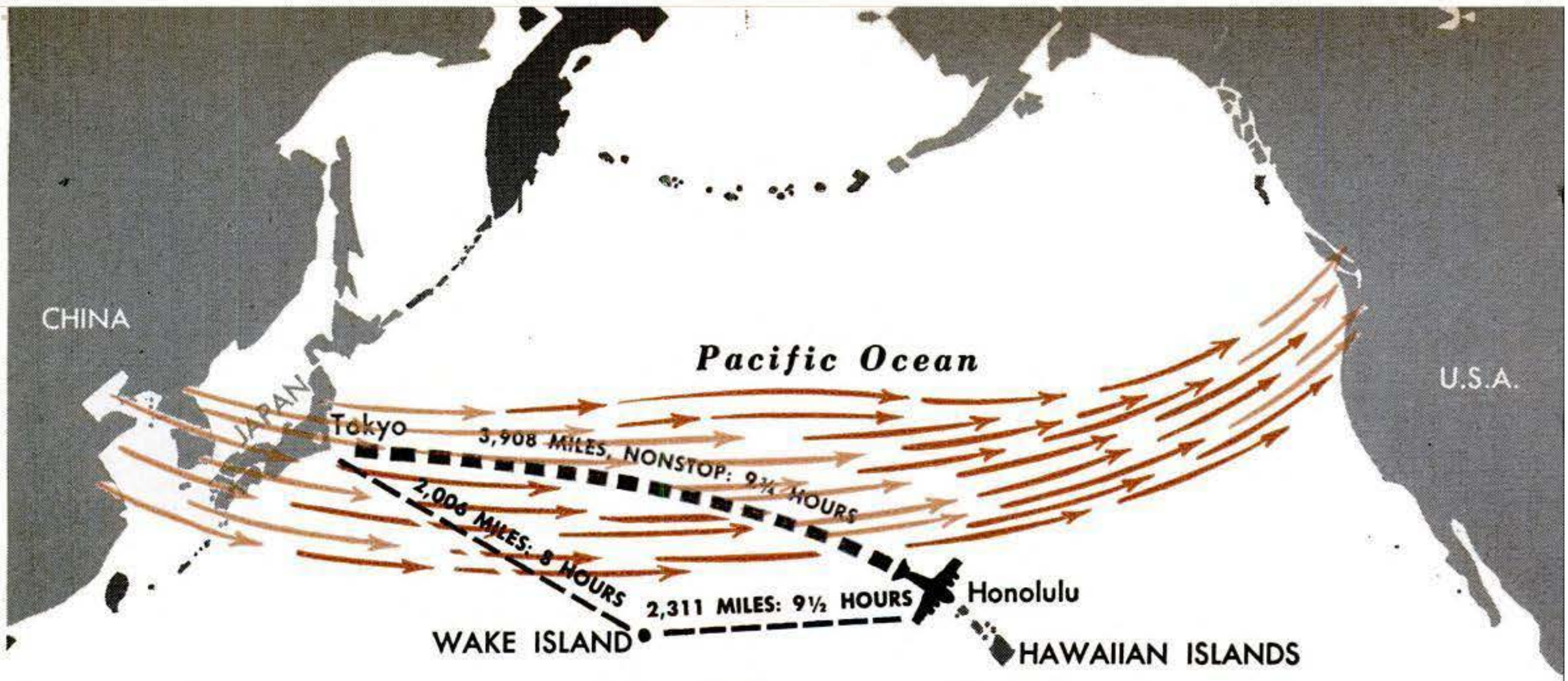

Riding the Earth's Mightiest Tail Wind

Pan Am Stratocruisers turn back the clock as they soar in on a six-mile-deep, 300-mile-wide river of air.

By Frank J. Taylor

ONE sparkling November day in 1952 Captain Logan D. Scott, with 47 passengers and a crew of six aboard his Pan American World Airways Stratocruiser, made transportation history. Taking off from Tokyo, he streaked due east across the vast North Pacific void and in 11 hours, 30 minutes, glided into the Honolulu airport, whacking seven hours off the previous schedule between Japan and Hawaii. It was the longest airline flight ever made.

Captain Scott achieved this feat by riding a monstrous, recently discovered, high-altitude river of air that whips around the earth in constant eastbound gales. Riding this fantastic wind, called the Jet Stream, Captain Scott not only saved time for passengers but $1,600 worth of fuel for his airline on the single flight. Previously Pan Am flights had winged 2,006 miles southeast from Tokyo to Wake Island, where they refueled, then hopped 2,311 miles to Honolulu. On his historic flight Scott flew 3,908 miles nonstop.

During the winter of 1952-53, 34 other routine Pan Am flights repeated Captain Scott's spectacular feat. Captain Mark Orr flew from Tokyo to Honolulu in nine hours, 48 minutes, cutting the old schedule almost in half. Picking up a day calendarwise as they crossed the international date line in mid-Pacific, delighted passengers joked about arriving in Hawaii "before we left Japan."

Meteorologist Sid Serebreny, a stocky, voluble man who has been analyzing this mystery river of air for Pan American since 1945, can claim a large share of the

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Here's what you see from a Boeing Stratocruiser flying the Jet Stream high over the Pacific.

credit for these swift Stratocruiser flights. His charts show that the colossal atmospheric river is six miles deep and up to 300 miles wide. At its center the "river" attains staggering velocities approaching the speed of sound. In its outer fringes, where the Big Wind blows more slowly, it still offers pilots helpful tail winds of 60 to 100 miles per hour.

Pilots Fly Tail Winds Both Ways

Paradoxically, directly beneath these high-altitude eastbound gales, the 30-mile winds "downstairs," under 10,000 feet, are generally blowing in the opposite direction, west. Thus, by carefully picking their altitudes and courses, Pan Am pilots—thus far the only nonmilitary pilots to use the Jet Stream regularly—are able to fly with tail winds both directions on the same day.

In March, it has been found, the Big Wind rises too high for planes to ride it. Serebreny and other meteorologists have tracked its movements through skyward soundings made by radar-equipped weather balloons, which report back the humidity, temperature, wind direction and wind velocity at every thousand feet up to 50,000. These ingenious balloons are sent up four times daily from weather stations in Japan, Wake, Midway, Hawaii, and from three Coast Guard weather ships stationed in the Pacific between Japan and our West Coast. Their findings are augmented by reports from airline, Air Force and Navy pilots flying the Pacific.

"It goes upstairs for the summer," Serebreny explains. "But it always seems to be back by mid-October."

Since 1944, when B-29 crews bombing

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Japan from the newly captured Mariana Islands—Guam, Tinian, Saipan—ran into trouble with fantastic head winds over Japan, a lot has been learned about the vagaries of this fascinating high-altitude torrent. The Superfort airmen reported that, reaching Japan at the 30,000-foot elevation, well above the flak, they often stood still though their engines were pounding at full throttle. All too frequently fuel reserves ran so low while they battled these head winds that crews had to jettison bomb loads and head for home to avert crash-landings in the Pacific. General Curtis LeMay, commanding the strategic bombing squadrons at the time, solved the immediate problem by ordering his airmen to fly in at low levels, regardless of antiaircraft barrages. After releasing their bomb loads on target, they climbed high and rode the tail winds home.

Later, when the Japanese surrendered, the Americans learned that the Nipponese meteorologists knew about these furious air currents. In fact, their military leaders regarded them as a secret weapon, and tried to float hundreds of firebomb balloons across the ocean on them to ignite forest fires on our West coast. A number of these balloons accomplished their mission, some landing as far east as Montana.

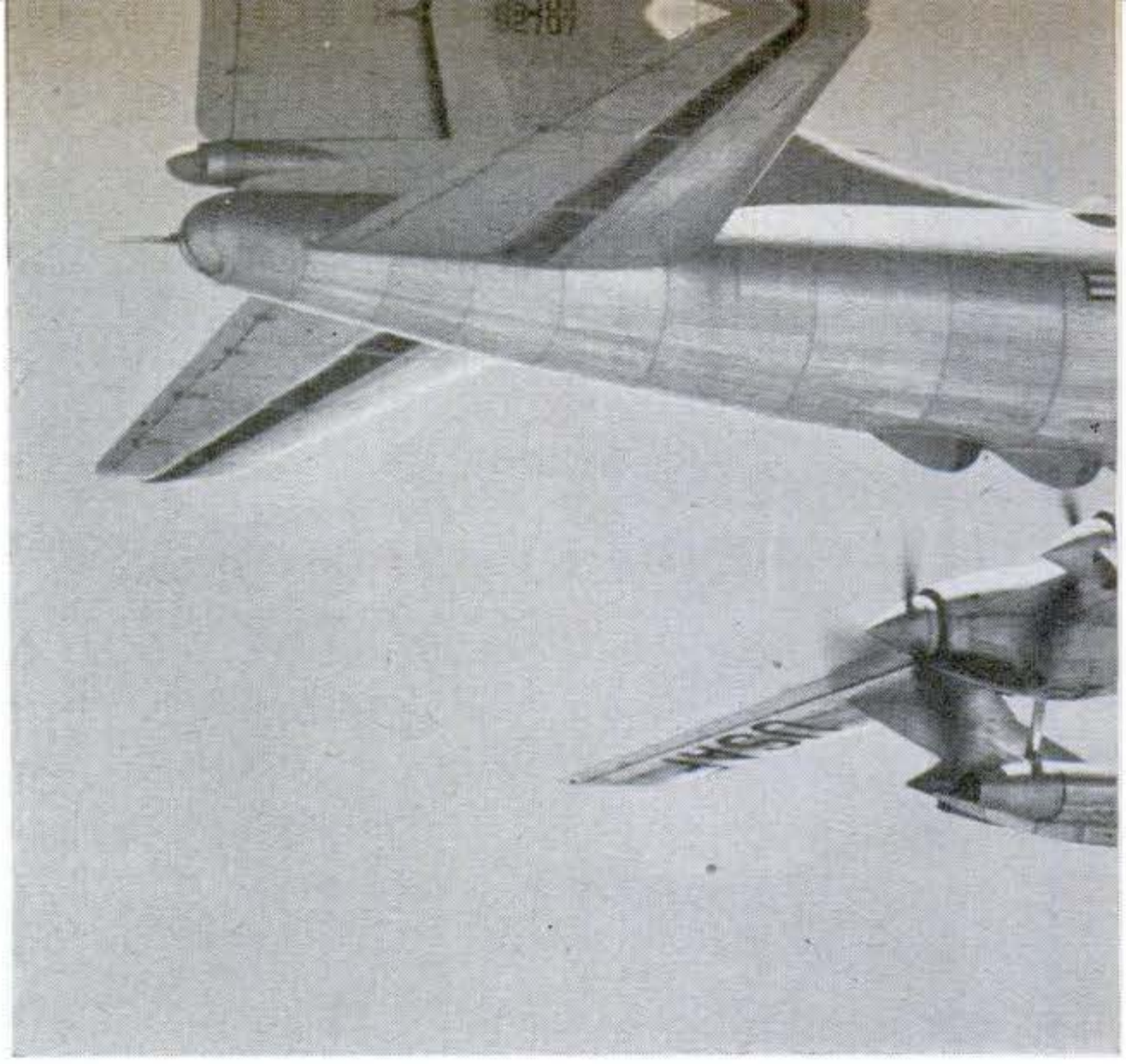
Jet Stream Circles Earth

Meantime, high-flying American Air Force pilots had encountered the Big Wind over Ohio and other points in the United States. British Royal Air Force pilots reported it over Europe. But it wasn't until 1947 that a University of Chicago weather team pieced together the fragmentary weather reports from around the world and learned that it was a global wind raging endlessly around the earth, roughly 2,000 miles north of the equator.

They gave the river of air its official name, "The Jet Stream." From Australia and New Zealand came reports indicating the existence of a corresponding Jet Stream south of the equator.

The Northern Hemisphere stream, potentially the more useful because it parallels historic trade routes, splits at various points, just as a river sometimes forks. One of these splits occurs when the stream bubbles over into the vast Himalayan mountain range. The northern fork pours torrentially across China, where it is given a push by tremendous pressures of cold Arctic air from Siberia. At 38,000 feet above Japan the winds whip eastward at 450 miles an hour. This is the fastest wind speed on earth.

By the time the Jet Stream reaches the California-Oregon coast it has slowed down somewhat, just as a river slows down when flowing through flat lands. But it still blows at great velocity as pressures over the Cascade-Sierra Nevada escarpment divert it upward. Then it swirls over the Rockies, across the United States, the Atlantic and Europe, and back to the Himalayas for a new "kicker." Use of the Jet Stream across these areas is still in the realm of speculation, for planes cannot yet fly high enough.



Kangaroo Rig Gives Bomber a Fighter's Speed

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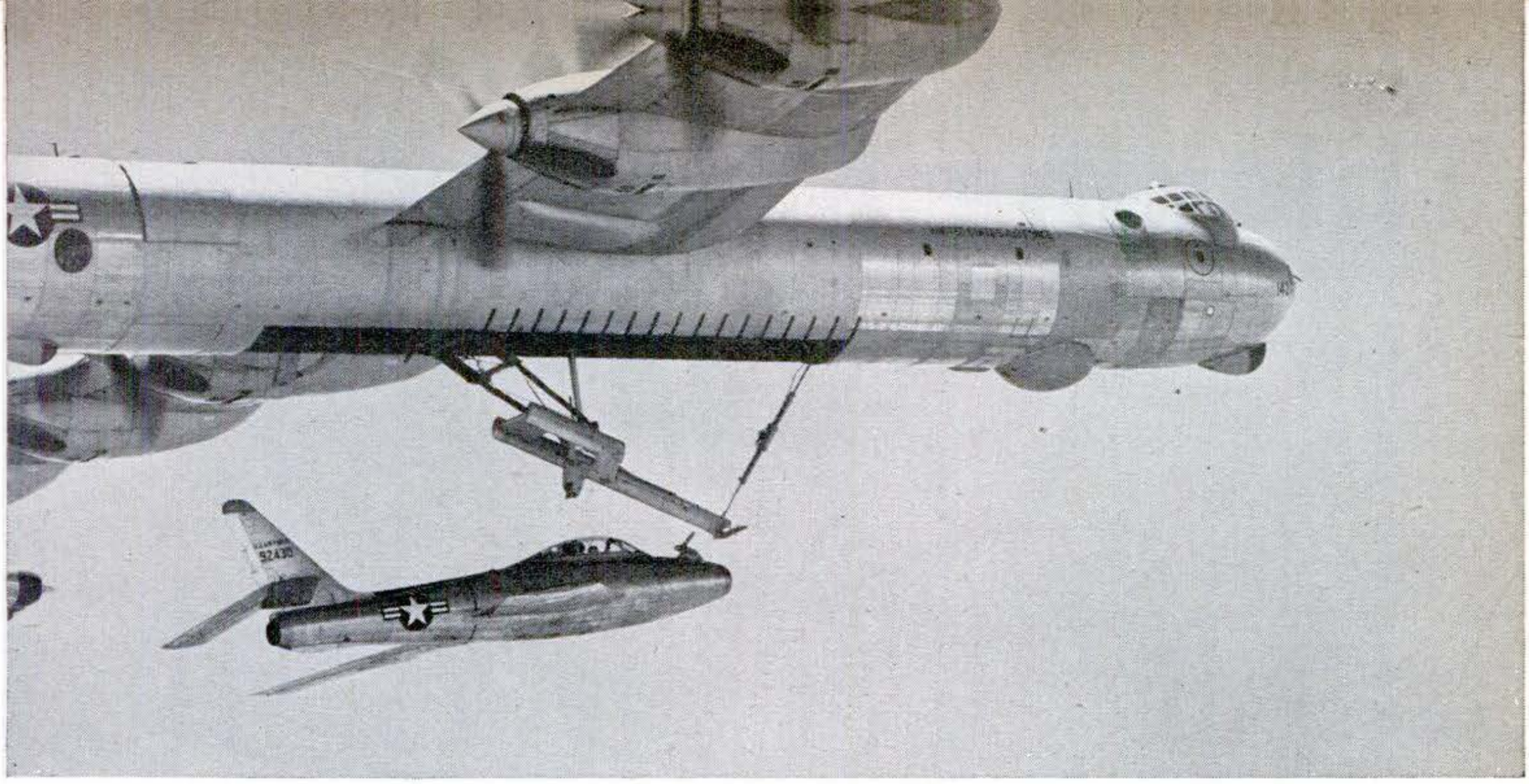

RIDING the Jet Stream is only one of many ways that big planes can speed bomb delivery. Now a 435-m.p.h. B-36 can carry a Thunderstreak 4,000 miles—then drop the fighter-bomber to make a supersonic A-bomb run over the target. Snuggled half into the bomb bay, the Thunderstreak rides in a frame, which is lowered for the fly-off. To hook on again (above), the jet catches frame in a nose hook, a latch engages behind cockpit, and frame and plane are hoisted back into bomber's belly. Air launching saves gas, increases Thunderstreak's 850-mile combat radius. Long-range photo flight is a likely use of rig, first tested with reconnaissance aircraft.

Meteorologists are not yet entirely agreed on what powers the Big Wind, or how to account for its meanderings. They need more data, particularly from China, Tibet and Siberia, where the northern Jet Stream apparently is regenerated for its 25,000-mile swirl around the globe. American weathermen in Japan, now working closely with Nipponese meteorologists, glean all they can from Soviet radio weather broadcasts. But today the Russians regard the Big Wind as their secret weapon, which it could well be, if their bombers rode its gales to this country as the Japanese utilized it, less efficiently, for fire-bomb balloons.

Earth's Rotation Adds Velocity

Serebreny, who knows as much about the northern Jet Stream as anybody, thinks of it as a vast current of swirling atmosphere sandwiched between the continuously rising warm-air masses at the equator and the cold fronts steadily pushing in from the polar regions. The pressure caused by the two merging fronts, Serebreny believes, is at least partially responsible for the stream's great velocity. Another factor is the earth's rotation. When the Northern Hemisphere Jet Stream goes upstairs in summer, the one south of the equator comes downstairs. The reverse is true in winter.

When meteorologists first suggested putting this invisible force to work for air travel, pilots were skeptical. Passengers' lives were at stake. Suppose the pilots didn't find the tail winds where the weathermen said they would be, and ran out of gas over the ocean? Only rarely is the Big Wind visible to the eye in the form of bannerlike "mares' tails" of high cirrus clouds. Serebreny and other meteorologists devised an ingenious plastic model of the Jet Stream to visualize its seasonal pattern for briefings of pilots and navigators. The crews agreed to make exploratory flights—if Serebreny was so sure of his "weather stuff" that he would fly with them. The first of these

[Continued on page 260]

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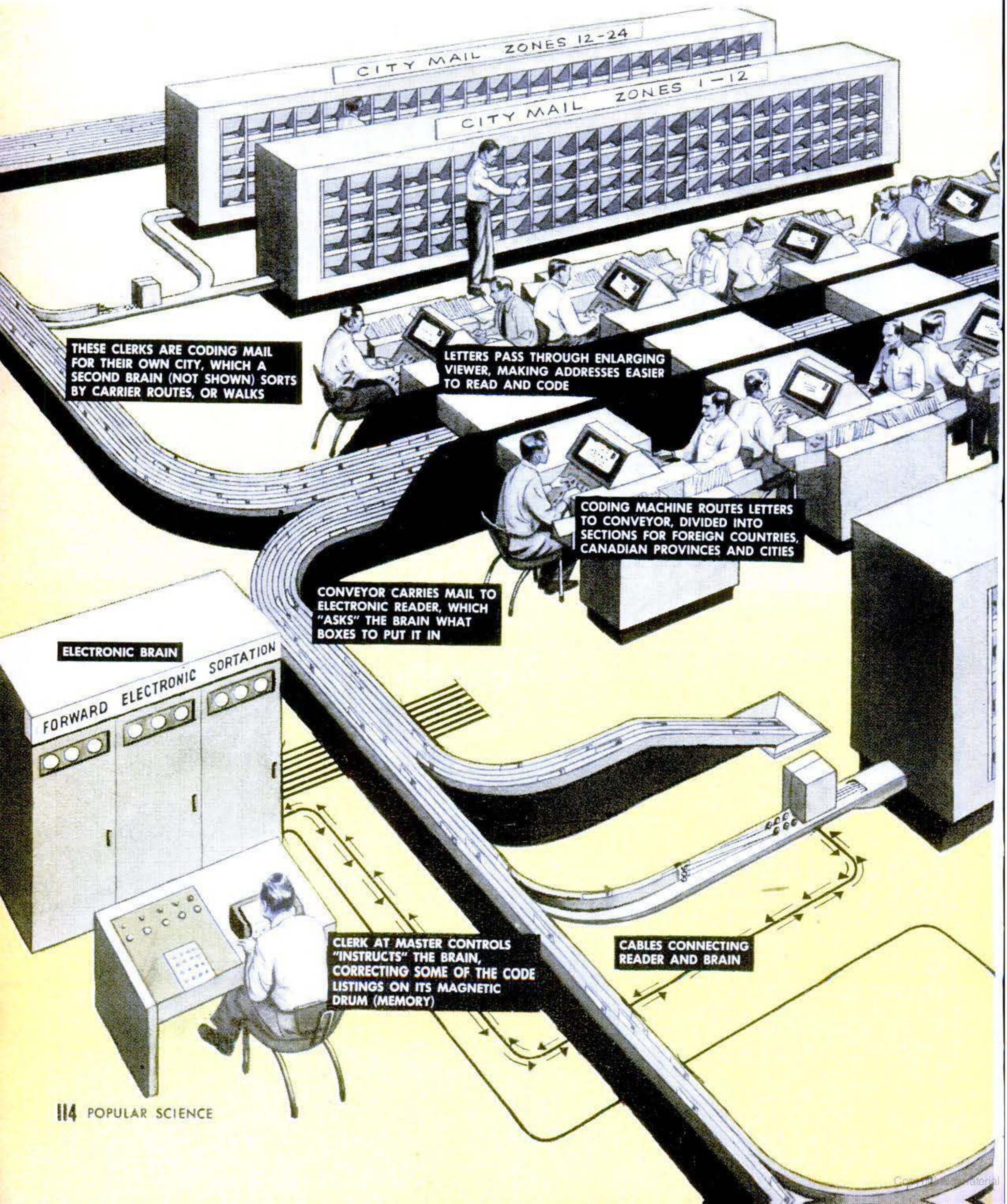
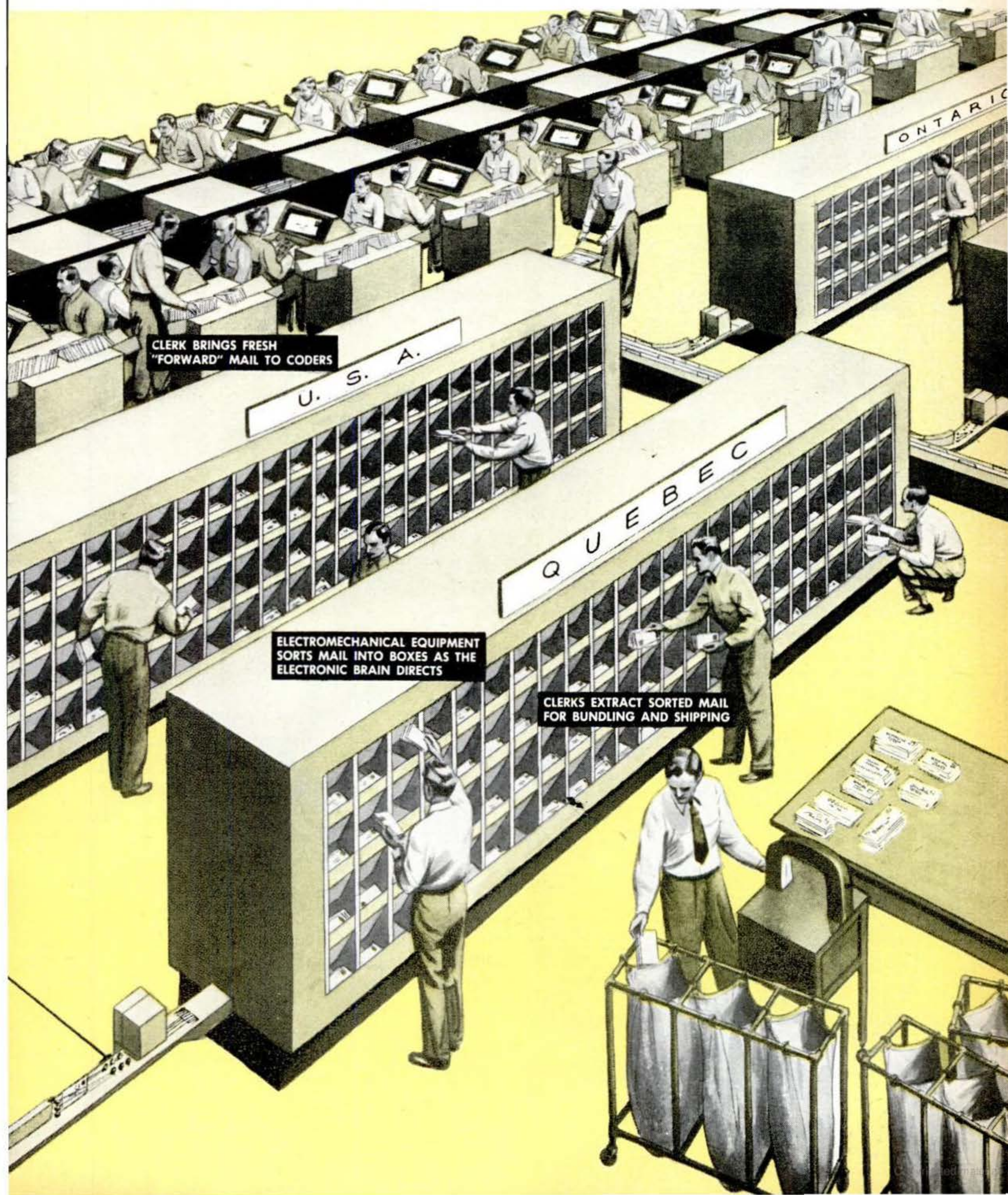
Thinking Machine Will Speed Mail

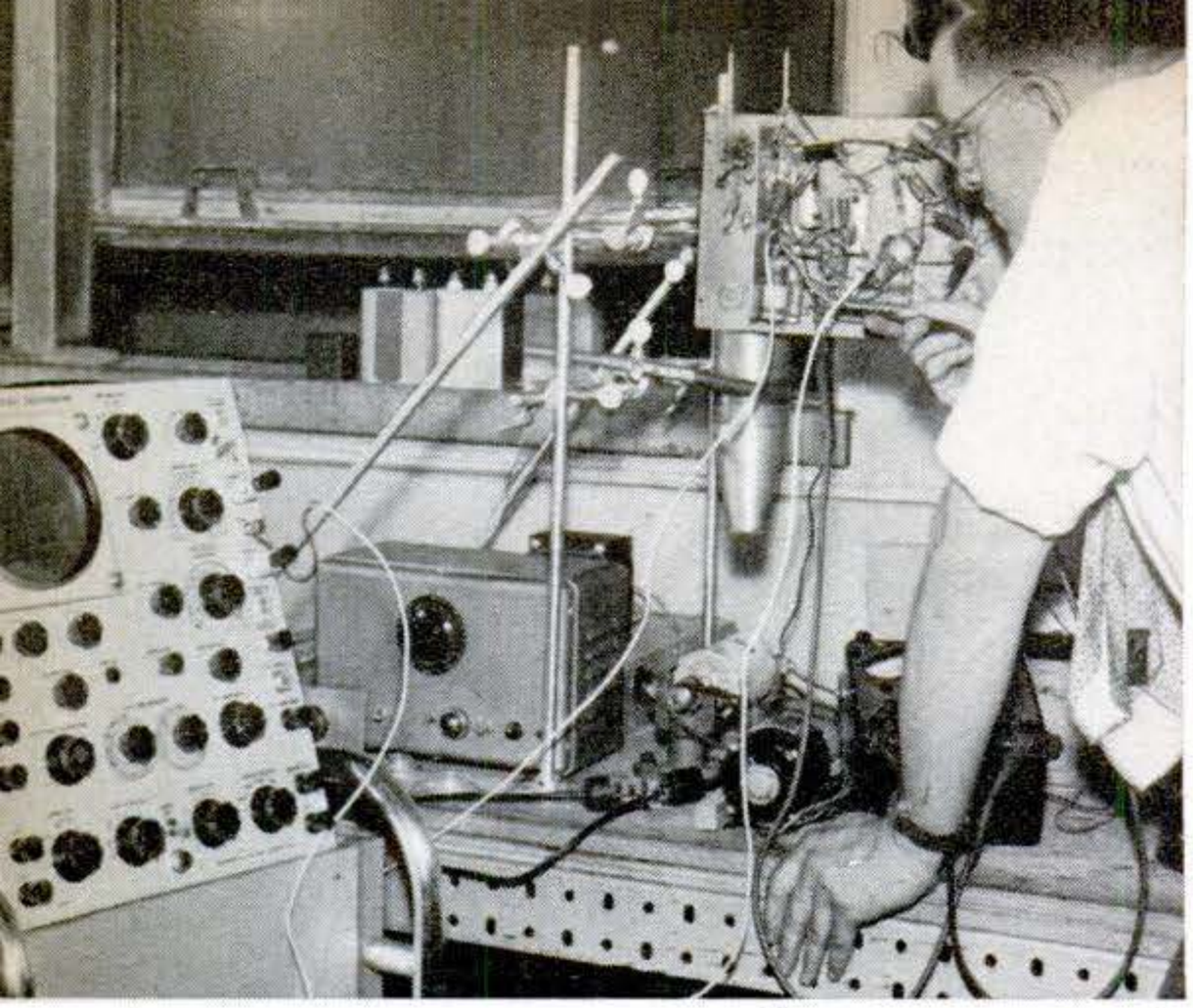


An electronic memory will make life a lot easier for Canada's postal clerks and sort out the letters faster.

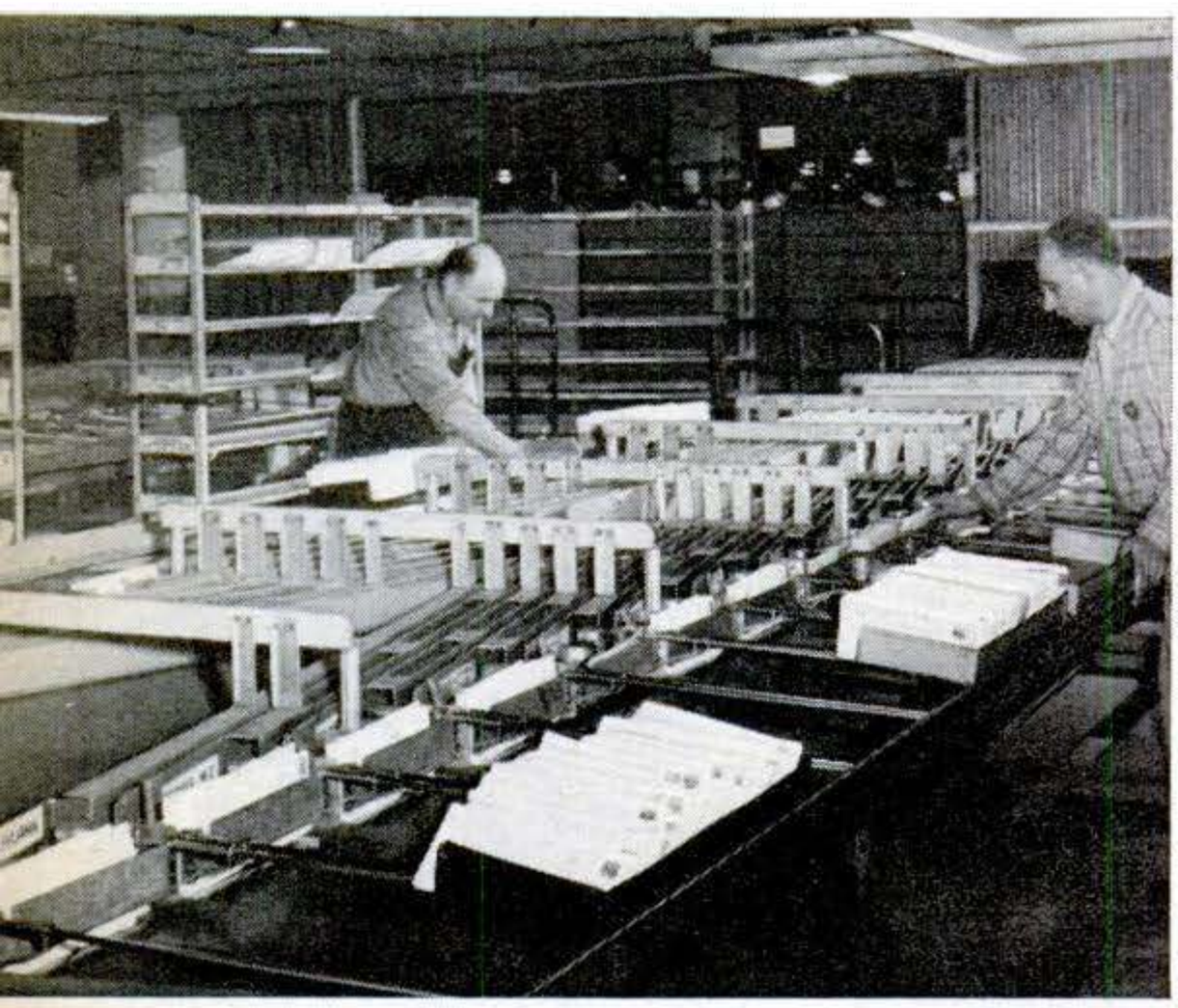
CANADA is creating an electronic brain to take an overwhelming load off the minds of its postal clerks and help sort mail faster than it is done anywhere else in the world.

Other countries, including the U. S., Holland and Belgium, have built machines that extend the reach of a mail clerk's arm and speed up the routing of inbound and outbound letters. But nobody had done anything to lighten the burden on the poor clerk's memory until



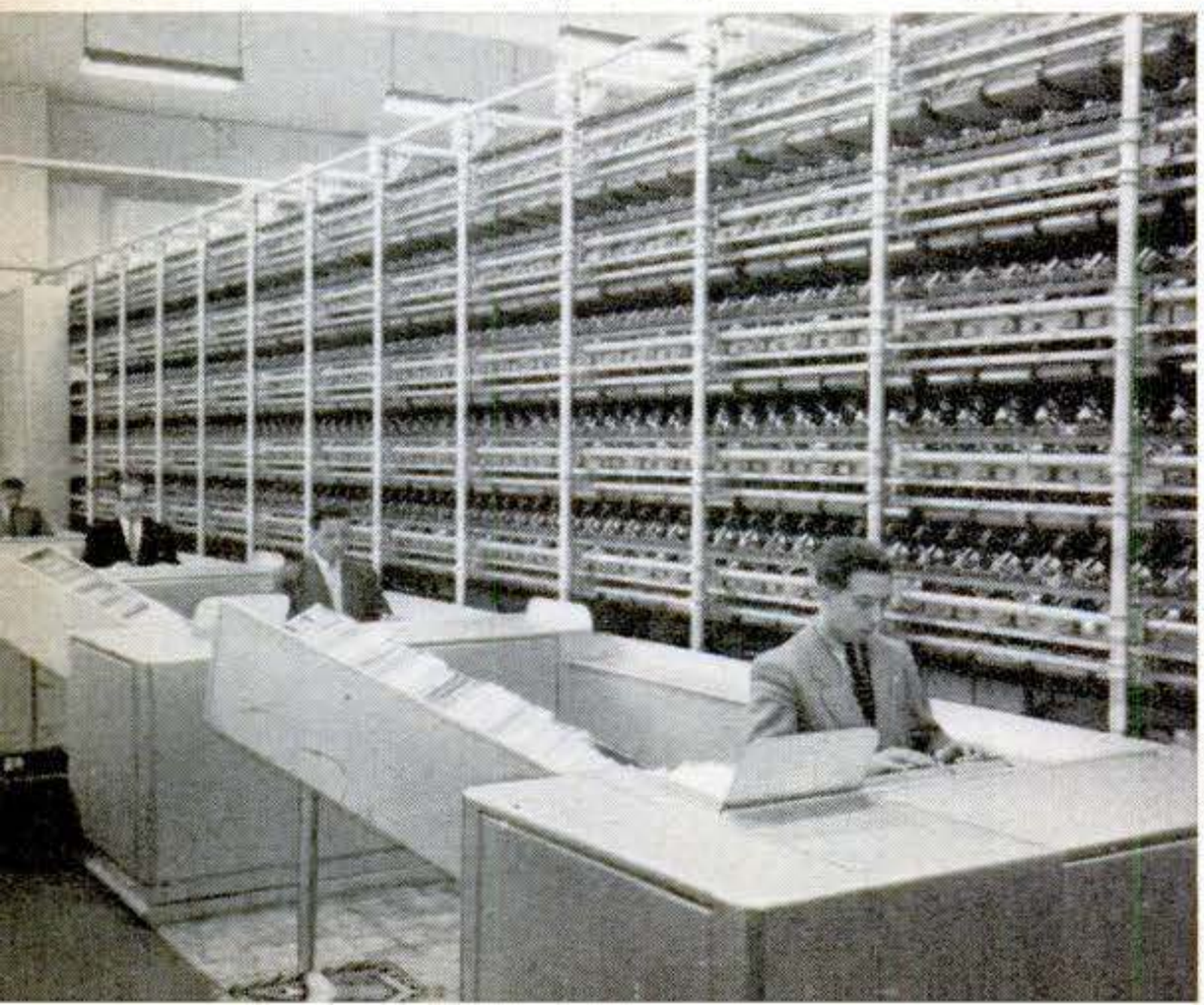


EXPERIMENTAL "READER" for scanning code markings on letters traveling through Canada's forthcoming electronic mail sorter is tested at Post Office Department's Ottawa lab.



AN AMERICAN ATTEMPT to speed mail sorting is the Sestak machine in the Chicago post office. Mail hand-sorted a floor above is funneled continuously to 36 stacking stations below.

A BELGIAN MACHINE (below), by I.T.&T., requires coders to memorize numbers for hundreds of towns. Canadians will merely have to remember a simple way to code any address.



Canada recently tackled the job.

There are more than 12,000 post offices in the vast territory of Canada. Their number, as in every growing country, is steadily increasing. One man, if he were incredibly gifted, might possibly remember their names and locations. He couldn't possibly remember, in addition, the routes that mail must take to get to all of them, or the names of the many smaller communities serviced by them.

That memory load is now shared by a lot of men in the post offices of Canada's 17 largest cities, where 70 percent of the country's mail is sent and received. Three years from now, the first of several electronic brains will take over. The drawing on the two preceding pages shows how it will probably look and work.

The essential first step in starting a letter through the electronic mail-sorting system will be stamping the back of its envelope with a coded version of its address, translated into a pattern of ink dots. The coding machine will also kick off the letter on its brisk journey through a conveyor to an electronic "reader."

Reader Consults Brain

This reader, which may be a photoelectric cell or a television-type, "flying dot" scanner, will halt the letter for an instant and flash the code it has read on the envelope to the brain of the mail-sorting system.

"Where'll I send this?" it will be asking, in effect.

The brain's "memory" will exist on a drum that functions somewhat like the cylinder in a dictating machine. On that drum will be recorded magnetically the names of all the post offices in Canada and a good many abroad, plus information on the proper postal routes to each.

At the electronic reader's query, the brain will be able to search its formidable memory in one thirty-sixth of a second and tell the reader where to shoot the letter it is detaining.

The team of experts who are developing the Canadian electronic mail-sorting system say that the brain will be capable of routing 130,000 letters an hour. This

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is such a breath-taking pace that the machinery for carrying the sorted letters to post-office cubicles from which they will be taken and bagged for delivery is unlikely to be able to keep up with it. However, the least that will be demanded of the conveyor system is a distributing rate of 10,000 letters an hour.

It is expected that each major Canadian post office will eventually have two electronic brains. One will remember all street and zone "splits" within the city itself, and sort incoming mail. The other will provide almost instantaneous total recall of all "forward" routes—to places elsewhere in Canada and abroad.

With the remarkable assistance of these electronic brains, fewer and less-skilled postal workers, assigned to the coding machines, will be able to sort much more mail than can be sorted now in a given length of time. Also, at least four fewer handlings will be needed to move a letter from writer to addressee.

Invented by Deputy Postmaster General

The electronic mail-sorting system is a brain child of W. J. Turnbull, Deputy Postmaster General of Canada. Mr. Turnbull, a short, nimble, white-haired man of meticulous grooming and deft wit, is a brilliant careerist in the Canadian Post Office Department. Nearly 39 years ago, he began work there as a file clerk.

As a kind of executive vice-president of the organization, he is, like most of the people who work for him, extremely dollar-conscious. That kind of attitude is essential to keeping up Canada's long and enviable record of operating its postal service without a deficit.

At the same time, Mr. Turnbull is a simmering source of new and often revolutionary ideas. Before his young research team was fairly launched on developing the electronic mail-sorting system, he was ready with suggestions on how a modification of it might sort parcel-post packages electronically.

"Oh, I've enough projects in mind," he laughingly told his chief research scientist, "to keep you fellows busy till your beards are gray."—*Wesley S. Griswold.*

"Arm" Hoists Worker 100 Feet

THIS mobile tower gives a steeple jack a 100-foot reach. Two steel booms connected by an elbow are maneuvered hydraulically on power from the truck's engine. A control on the high platform elevates or drops either boom or turns the tower 280 degrees. The 6½-ton rig, made by Mobile Aerial Towers, Fort Wayne, Ind., folds to 13½ feet high and 48 feet long.

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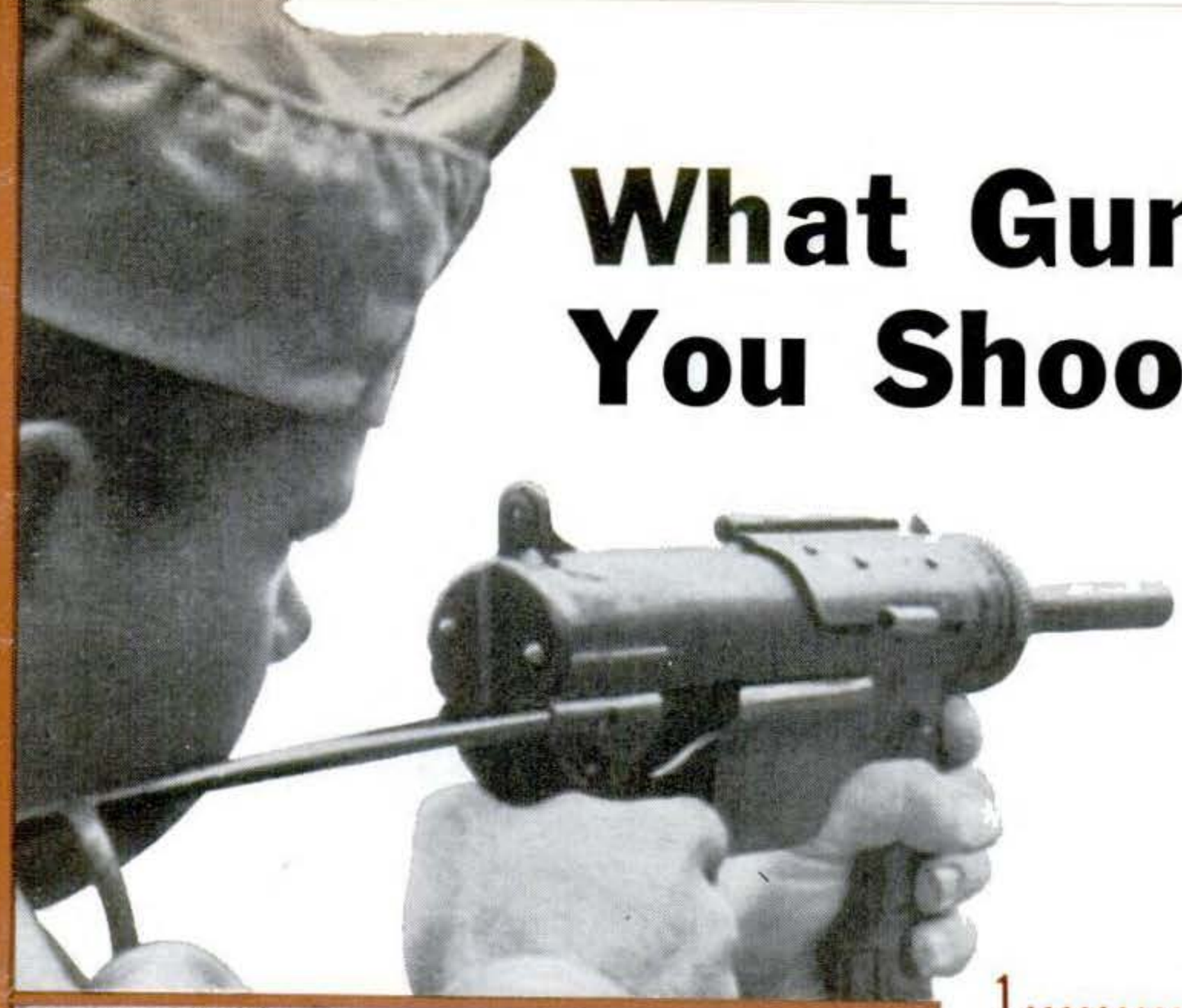
What Gun Are You Shooting?



1

2

3

4

5

5. U.S. automatic pistol, .45 cal., M1911A1 ("Colt"); 6. U.S. rifle, .30 cal., M1 ("Garand"); 7. U.S. carbine, .30 cal., M1; 8. U.S. rifle, .30 cal., M1903A1 ("Springfield"); 9. Kentucky flintlock; 10. Luger, 9 mm.

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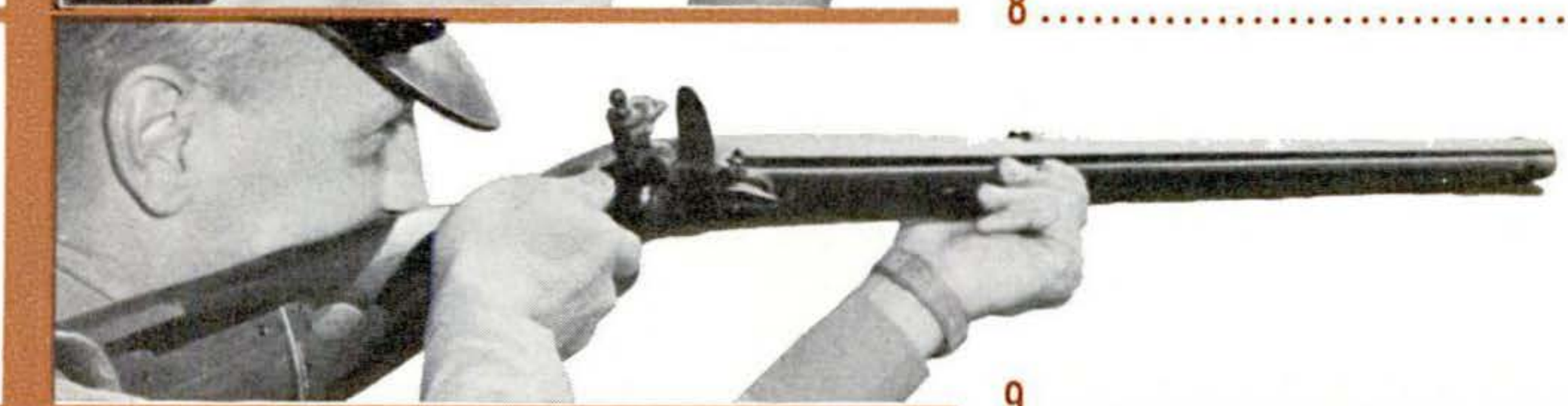
Try to identify each of these familiar small arms— then check with the answers at bottom of the page.

THESE pictures will test how sharp an eye you have for the differences that identify various small arms. The photos were taken with the cooperation of the National Rifle Assn., which provided the correct identifications below. Three hints: most, but not all, are U.S. military arms; not all are current models; at least one is a foreign gun.

6 .....

7 .....

8 .....



9 .....

10 .....

Answers: 1. U.S. submachine gun, .45 cal., M3A1 ("grease gun"); 2. Mauser '98, 7.92 mm.; 3. Officer's model Springfield single-shot carbine 1873, .45-70 cal.; 4. U.S. rifle, .30 cal., M1917 ("Enfield");

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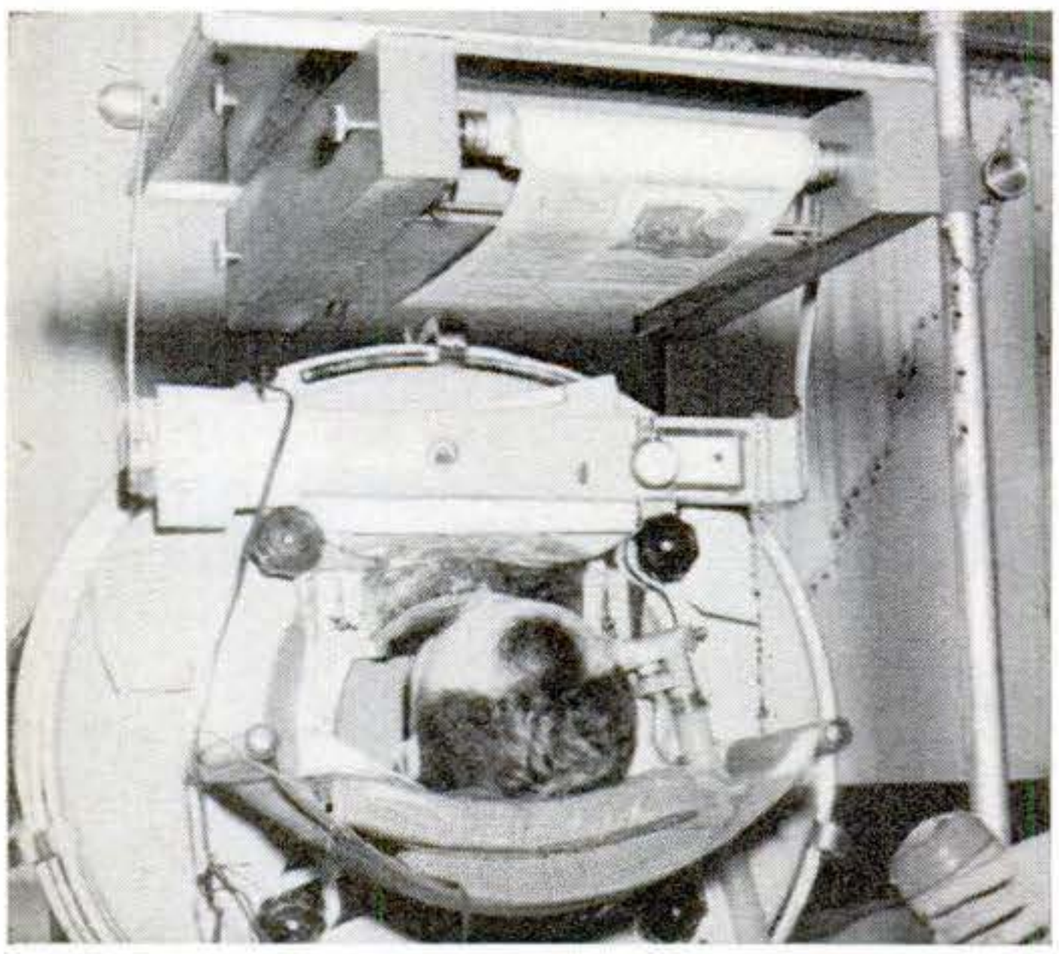
Leathernecks' New Blow-up Boat Can Take It

WHEN the Marines embark on an amphibious raid, the going is likely to be tough. But their new inflatable boats are built to take it. High rigidity, obtained by maintaining internal pressure at six pounds per square inch, enables the boats to be launched or landed in six-foot waves and to negotiate rough seas. Thanks to cutoff valves in the nylon fabric tubes that form the hull, the craft will stay afloat even if



Head Motion Works Roller Book

EVEN in an iron lung, the polio patient above can "turn the page" as he reads. Rolling his head from side to side starts or stops a motor-driven roller that moves pages pasted end to end. Ed Cook of Los Angeles built the device for a friend.

Horse MPs Ride the Air Waves

THE last mounted-police unit in the U. S. Army has gone electronic. "Ridie-talkies" allow a platoon that patrols woodland along the U. S.-Soviet sectors' border in Berlin to report to headquarters in a hurry in case of trouble.

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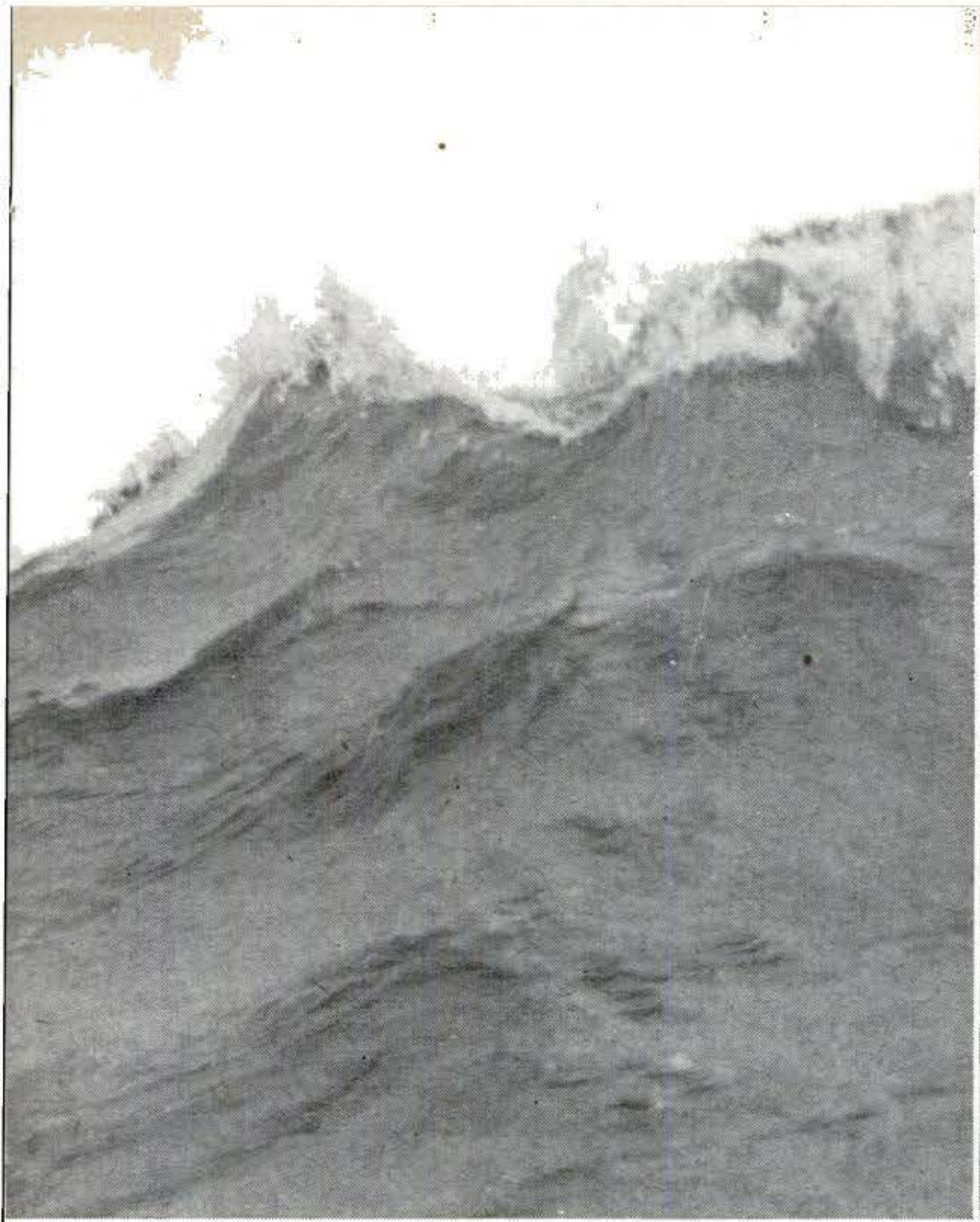


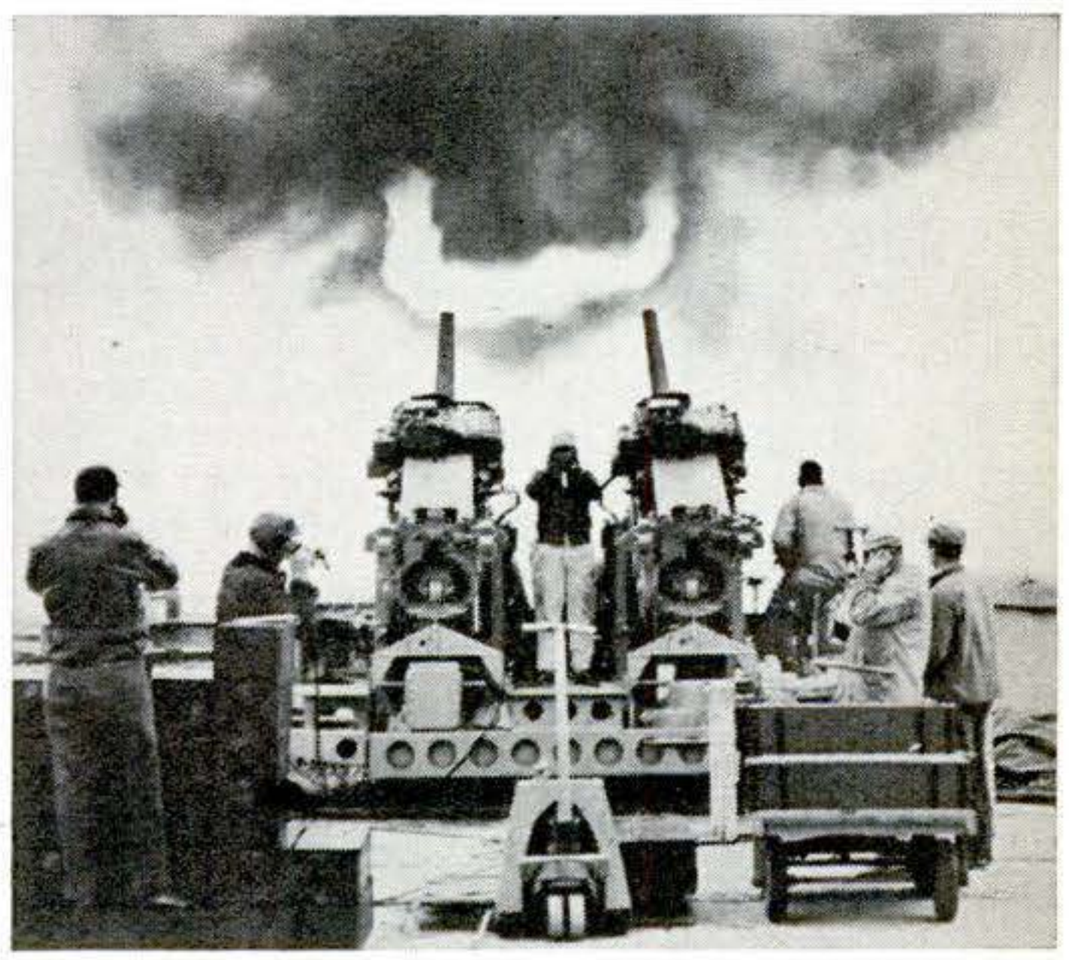
FOUR-MAN BOAT is unrolled above. It weighs 95 pounds. Below, Marines inflate 142-pound nine-man boat by hand method. Craft breasting 10-foot waves at left is nine-man size.

half the tubes should be punctured by enemy gunfire.

Designed and built for the Marine Corps by the Playtex Corp., the boats can be paddled, or kicked along by an outboard at 12 knots. An attached CO_2 cylinder inflates a boat in 30 seconds. Collapsed, the craft makes a small package that can be carried in a jeep or helicopter, or go through the hatch of a submarine.

Okay, Mister, Come Clean!

AMATEUR gumshoes can go to town with a new party game—a toy lie detector. The "suspect" fastens an electrode to each hand. Changes in his skin moisture, reflecting emotions, show on a resistance meter. Gokey Co., St. Paul, Minn., sells it.



Navy Tests New Rapid-Fire Gun

DRAMATIC firing tests of a brace of new three-inch, rapid-fire AA guns on a single mount (above) demonstrated their boost in firepower over previous types. The Firestone mount has 28,000 parts. The guns fire proximity-fused ammunition.

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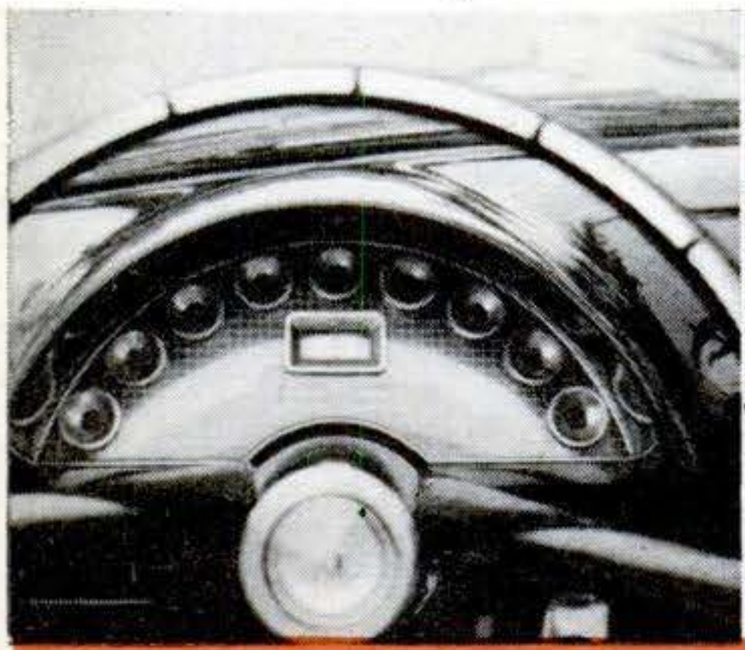
Ford Displays 50 New Ideas

Three-ton job goes like a shadow, has 24 electric motors—and heated seats.

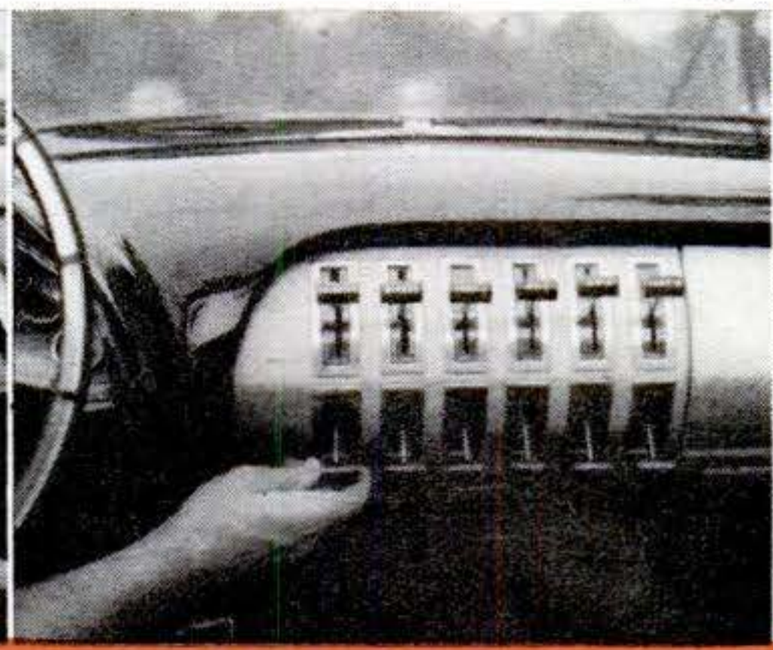
BILLED as a "completely American-designed" experimental car, the Ford Motor Co.'s X100 is popping the eyes of enthusiasts this month in London and Paris. Ford doesn't plan to sell the car but says it is a "laboratory on wheels for testing more than 50 engineering innovations."

A roadable job rather than just a showpiece, X100 does better than 100 m.p.h. at part throttle, and has never been flat out. More than 18 feet long, it weighs 5,900 pounds—despite use of light alloys—of which 665 pounds are electrical equipment. The car carries 24 electric motors.

COLORED LIGHTS tell you how it is throughout car. Gas gauge flashes green, yellow or red. Turn signals and horns (one is polite, one loud) work from buttons on wheel spokes.



LANDING GEAR UP? X100 has built-in electric jacks for each wheel. Hood is power-operated, too. Knob at upper left controls a new torque-converter drive Ford is developing.



JET IDEA is suggested by tailpipes centered in tail lights. Deck lid is motor-driven. Car has two batteries, extra charger, air-cooled rectifier and many AC circuits.

SO SHARKLIKE you might get a speeding ticket while parked, X100 is technically a convertible. Sliding roof panel of heatproof plastic retracts into fixed roof section. Motors operating it can be started by button, overtravel of door key or a drop of rain.

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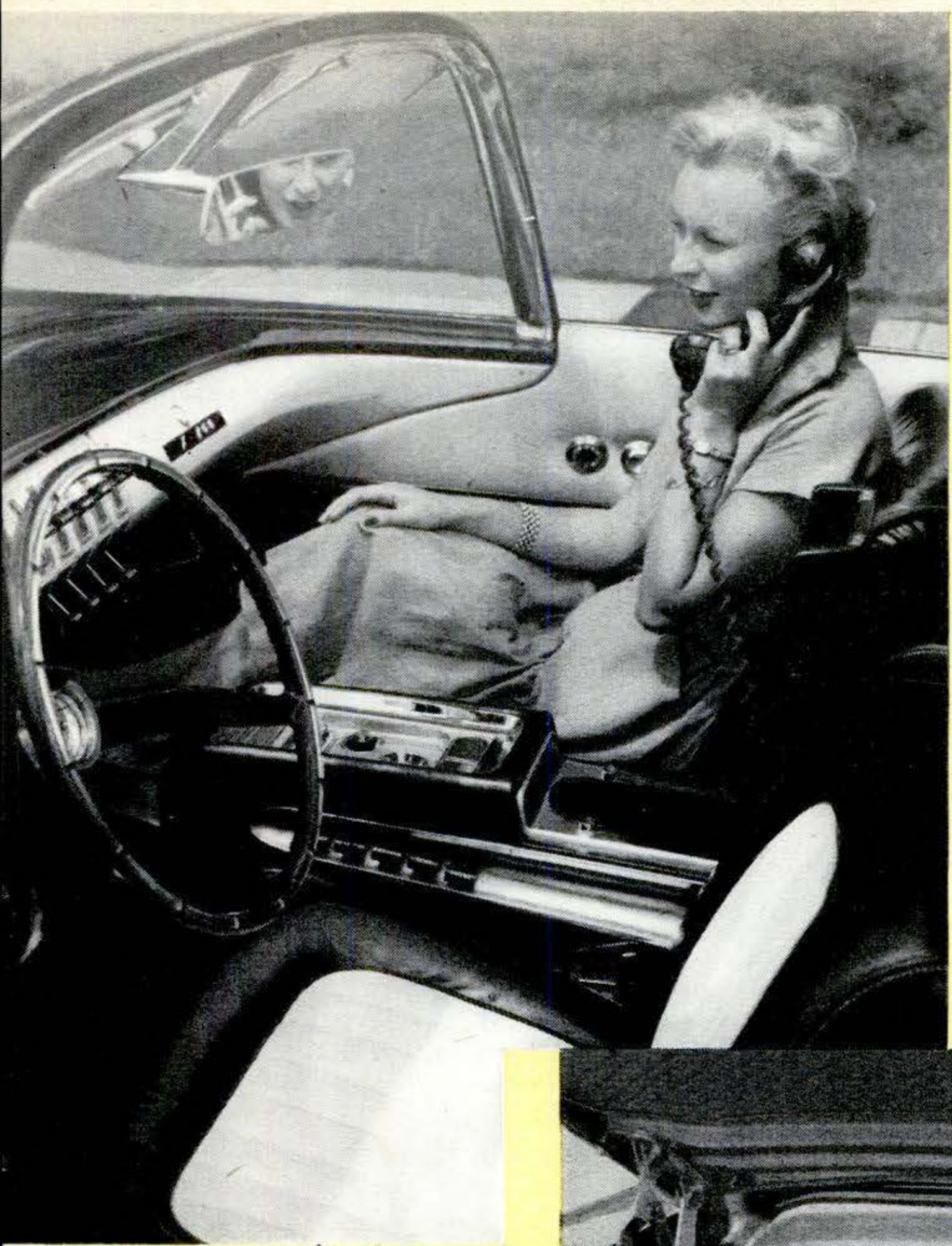
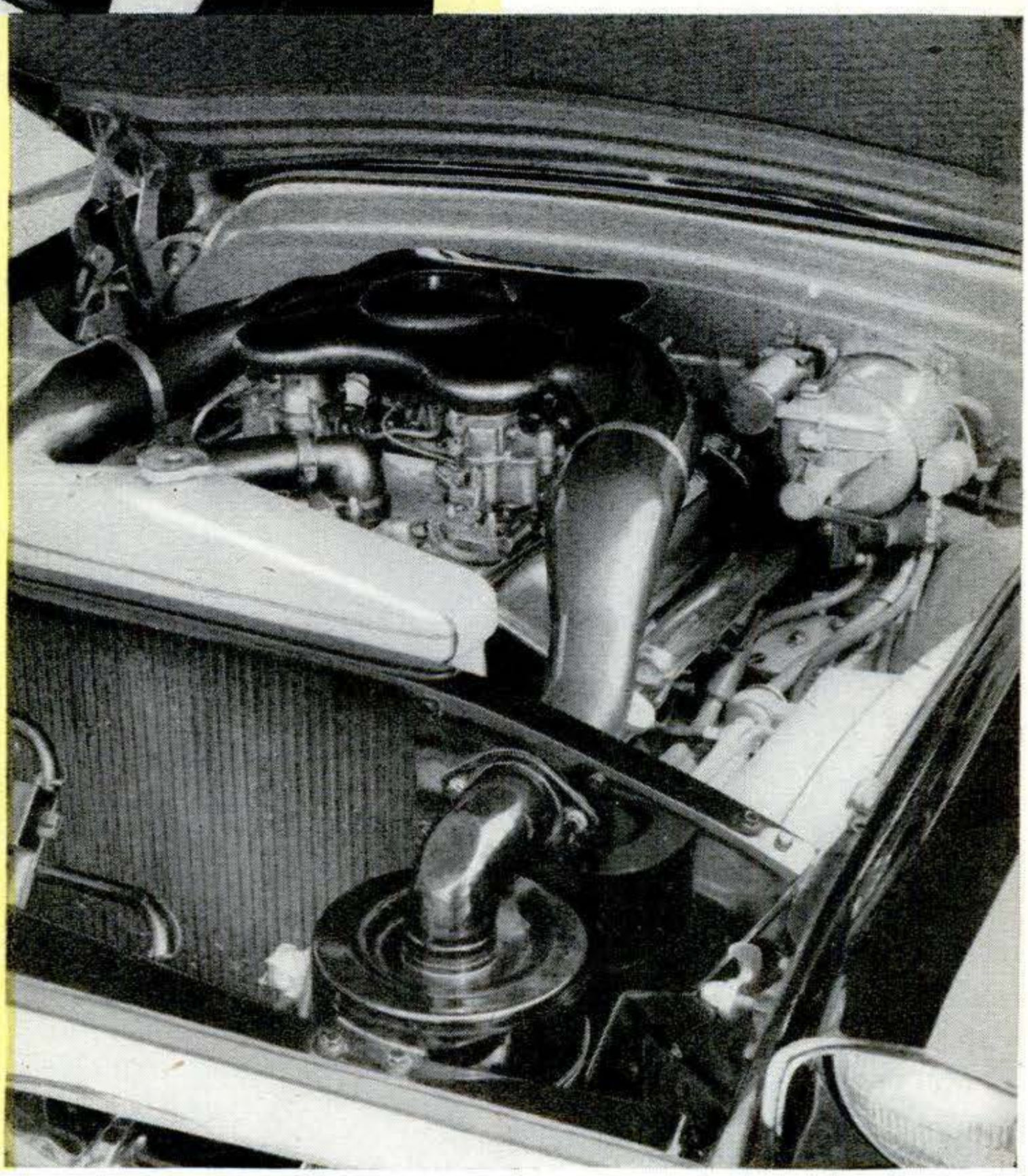


RADIOPHONE nestles in the central console, along with a signal-seeking radio, disappearing nylon safety belts and controls for six-way front seats. Motors tilt seats as well as move them up or down, forward or back. Electric seat warmers can take chill off leather in winter. Other built-ins for passengers include dictation recorder, electric shaver and an edge-lighted vanity mirror for lipstick repairs.

QUIET AS A WATCH, this engine can still slap out 300 hp. It began life as a Lincoln block and was hopped up by company engineers. Octopus arms are air-induction pipes; twin filter-silencers are at sides of radiator. Engine has a trick intake manifold and carburetor arrangement. At low speeds, it operates on two venturis of a central four-venturi carb. At medium speeds the other two venturis of this carburetor cut in. At full throttle four additional two-venturi carbs come into operation, giving engine all the breath it can take.



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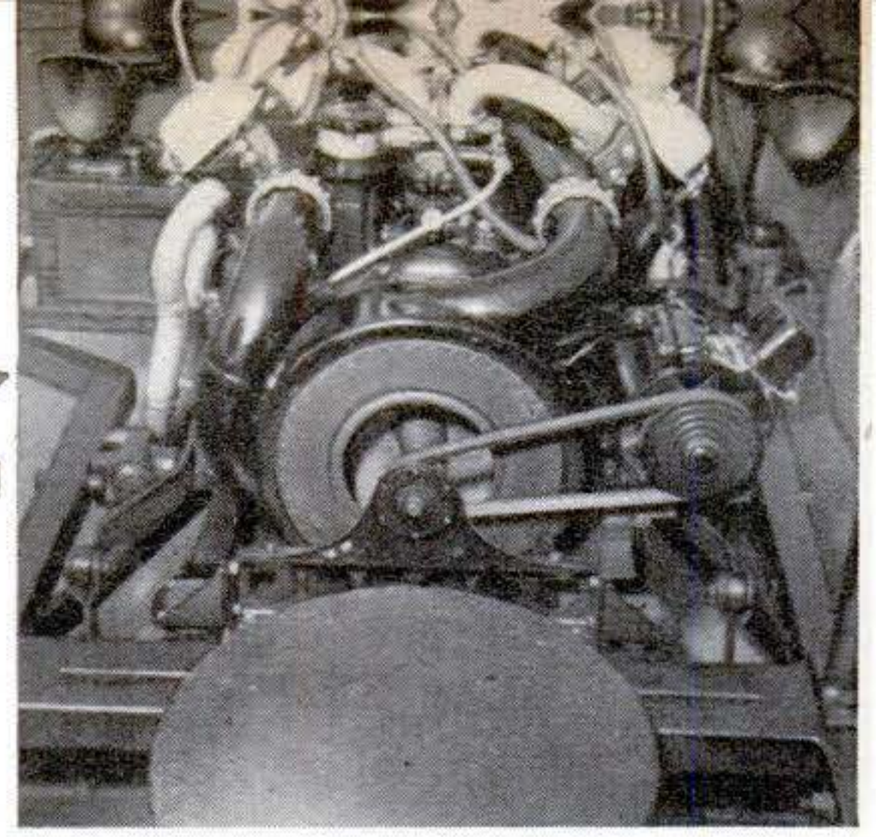

Twins in Tandem Drive Screaming Skeleton on Wheels

THAT naked-looking automobile up above has a two-in-line power plant—two engines, that is. A pair of air-cooled Rangers, coupled in tandem with lashproof gears, develop 60 horsepower. When owner O. L. Munding of Glendale, Calif., opens up, the twins wail like banshees as a 20,000-r.p.m. blower, above right, rams in air. Munding expects the 750-lb. car to make 100. So far he hasn't dared push her above 70, despite the lead weight on the front axle to hold her down at high speed. The car is a hybrid, using an Austin transmission, Crosley starter and steering gear. The Rangers were war surplus, originally designed to start big bomber engines.

PEE WEE JEEPLET, 62 inches from axle to axle, was also built by Munding. Powered by an American Austin engine, it has a plywood body on steel tubing, weighs only 600 pounds.

▶▶▶Permanent magnets containing no metal are being made from a brittle black ceramic-like substance. First use of the Magnadurs will be in TV sets to sharpen pictures.

Pilot's Helmet Carries Camera

WITH his movie camera perched over his ear, the Navy jet-fighter pilot above can take a picture wherever he looks. A cross-hair finder rigged in front of his right eye permits exact aim. Lt. Zeke Huelsbeck designed the rig while flying in Korea.

Right-Hand Jeep Totes Mail

THIS jeep with a steering wheel on the curb side lets postmen slide out fast to make pickups from city boxes or reach from the seat to deliver mail in rural areas. It has two-wheel drive, but chassis and motor are those of the standard Willys jeep.

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Custer Channel-Wing Transport Takes to the Air

A TWIN-ENGINE, executive version of the plane with two U-shaped depressions in the wing has been test-flown in California. Known as the Custer Channel Wing, the two-ton aircraft got off the ground in less than 100 feet.

The channel wing develops unusually high lift with slight forward speed because the propellers, half encompassed by the wing, force air backward over the airfoil surfaces. The conventional propeller-driven plane depends largely on forward speed for lift.

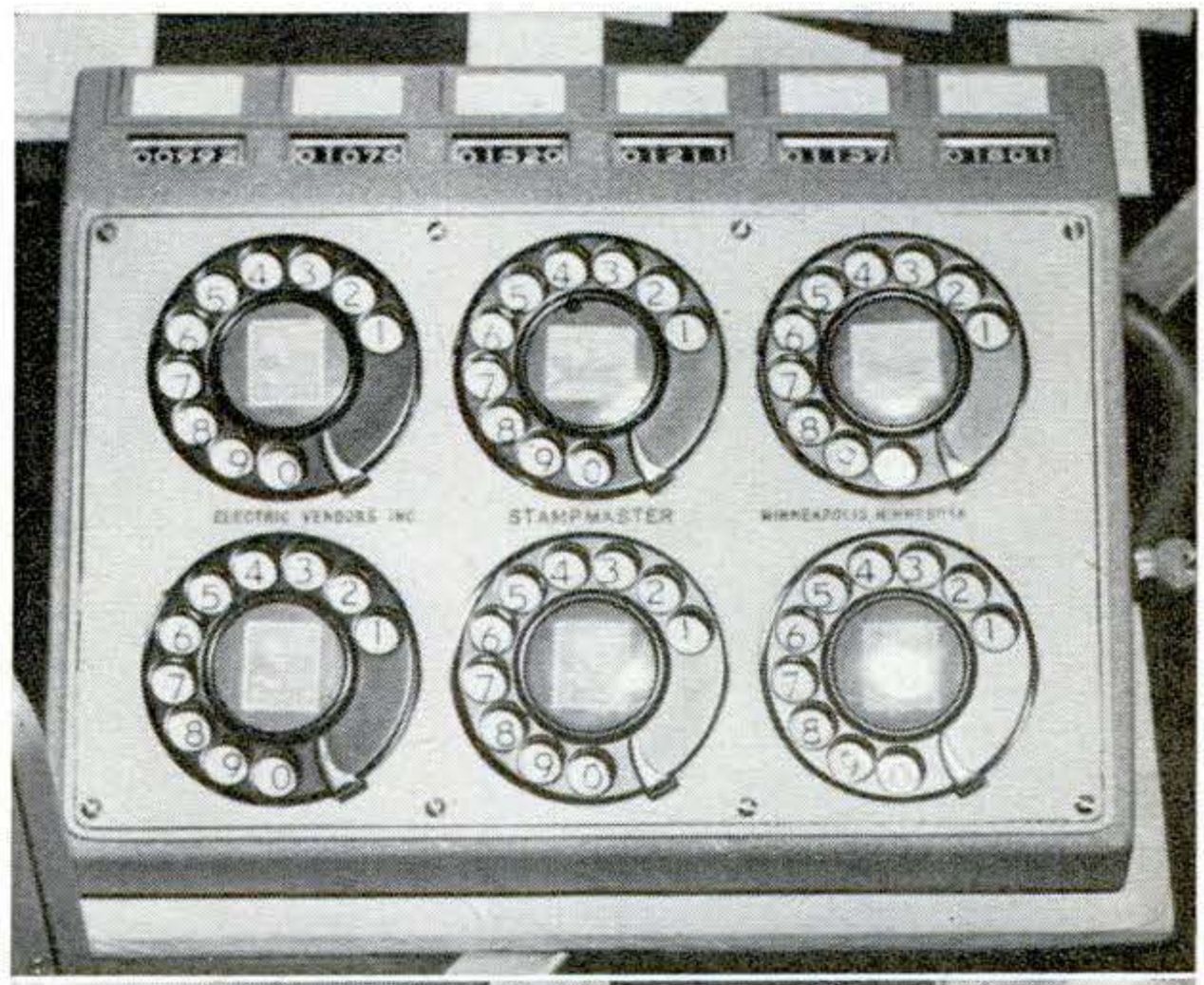
As though in answer to critics—if the wing depends so much on the props, what would happen if the engines cut out?—W. R. Custer, the inventor, reported that his airplane landed from its first test flight with the power off at a speed of less than 40 miles an hour.

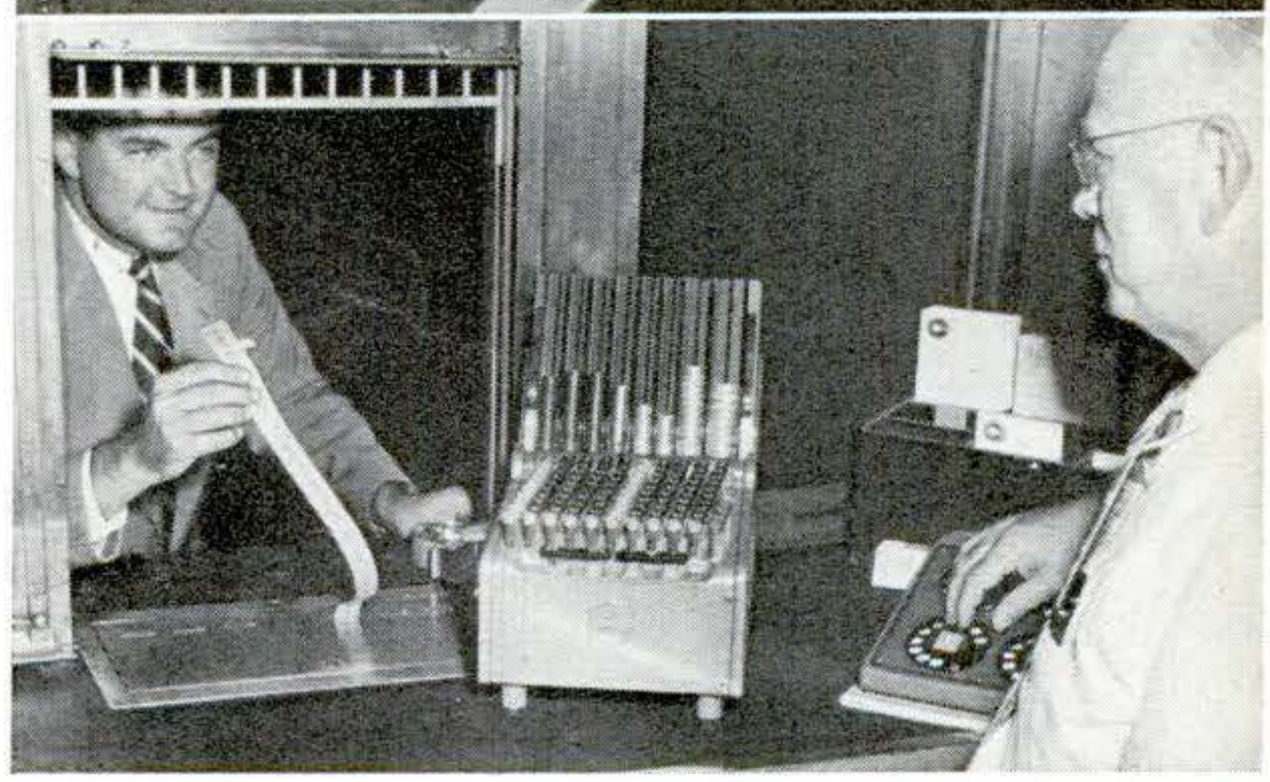
Postage Stamps Leap Out of New Vending Machine

AT THE twist of a dial, postal clerks in a few big U. S. cities, including Washington, Philadelphia and Chicago, can now flip a strip of stamps at you without touching them. The stamps, dispensed by a new, rapid-fire electric vending machine, spurt out of slots in the window counter like movie tickets, at a rate of 10 a second.

The control panel of the vending machine (top photo, right) has six standard telephone dials, for dispensing the denominations of stamps in greatest demand. The pleased customer in the lower-right photo is Deputy Postmaster General Charles R. Hook, Jr., who bought the first strip of stamps to pop out.

Beneath the counter are six standard coils of stamps. As the dial controlling one of them is spun, a low-priced solenoid drives a simple mechanism which reels out the dialed number of stamps. Electric Vendors, Inc., of Minneapolis, built the machine.





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U. S. geologists provoke debate in the West:

Is Grand Canyon's

Hell's Canyon, in the timbered Northwest, is awarded the decision over the Southwest's great scenic attraction.

MEN can measure the height of mountains with slide-rule accuracy—even mountains they cannot climb. But a great cleft in the earth is something else again. Do you compute from the loftiest knob along the rim or merely from

Hell's Canyon (below): From Barton's Height in Wallowa National Forest a U.S.

By Richard L. Neuberger

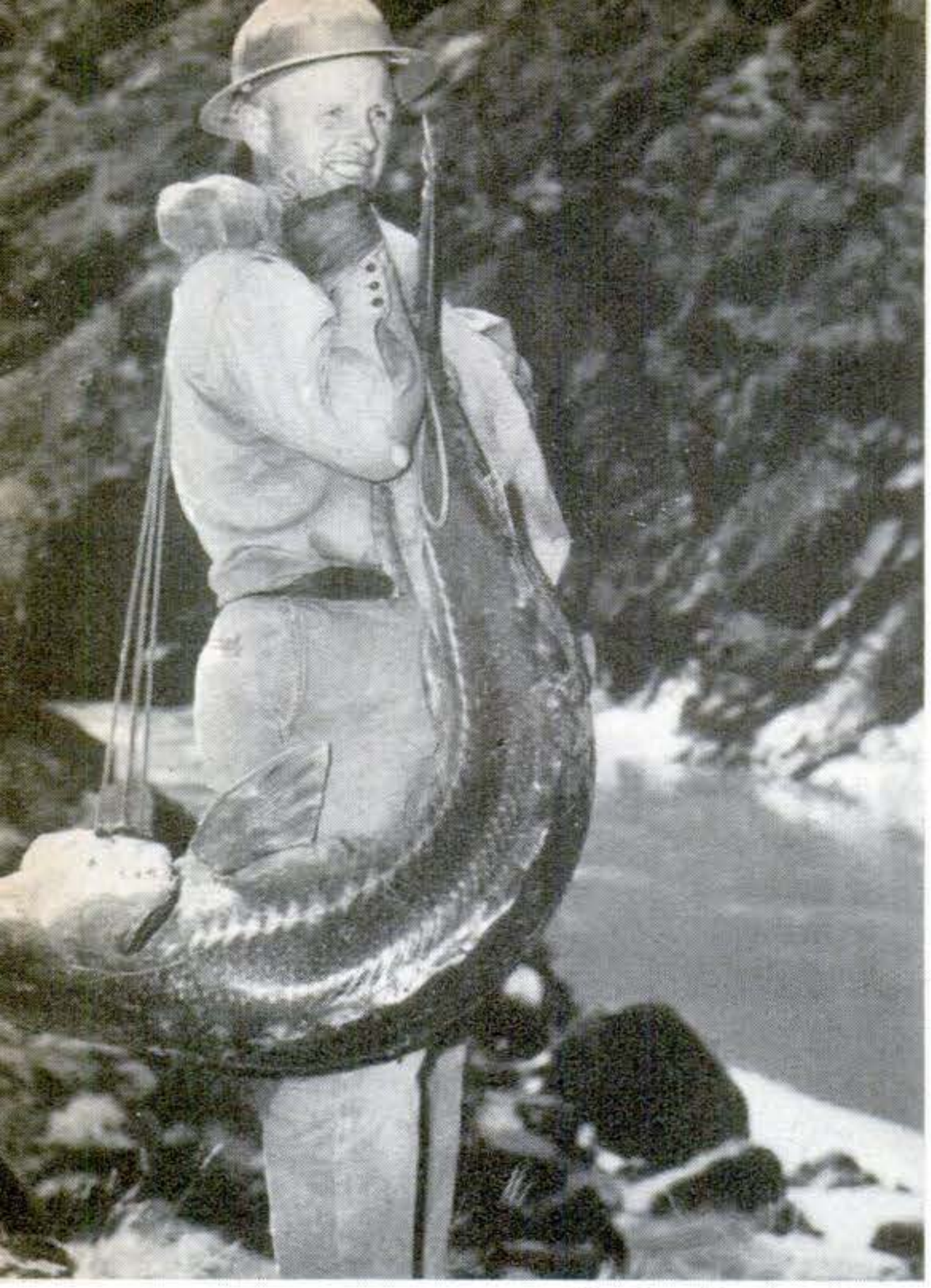
Rival Deeper?

GRAND CANYON: This view from Purple River Junction shows what a vast panorama is presented by the enormous, colorful chasm so often photographed by tourists.

plain, ordinary rimrock as it fences off blue space?

Back of this innocent question lurks a dramatic controversy. Where is the deepest abyss in all the land? Is it the celebrated Grand Canyon of the Colo-

forest ranger looks down on Snake River on Oregon-Idaho border 6,300 feet below.



HUGE STURGEON was caught in Snake River where it gushes through Hell's Canyon. Some, weighing up to 50 pounds, are filled with caviar. River also yields salmon.

DAREDEVIL wearing life jacket, just in case, gets set to hit white water in Hell's Canyon.

rado River, in Arizona, or is it Hell's Canyon of the Snake River, on the rugged border separating Oregon and Idaho? Combat simmers between the arid Southwest and the timbered Northwest over this issue.

Most citizens would cast their ballots unhesitatingly for the Grand Canyon, whose fame has spread around the globe.

Yet the official U. S. Geological Survey has voted decisively for the less renowned chasm:

"Below the mining town of Homestead, Ore.," states one of its water-supply reports, "the Snake River has cut through the mountain ranges that blocked its way to the Columbia Valley and flows in the deepest, narrowest canyon in the United States. . . ."

Partisans of the Grand Canyon, however, are shouting "Foul!" They refuse to accept as genuine rimrock the saber-toothed fangs of limestone above the Snake River, which account for the greater depth of Hell's Canyon. Yet these tusklike prongs are as close to the Snake in terms of horizontal distance as the final brinks of the Grand Canyon are to the Colorado.

The Grand Canyon, that abyss of dazzling colors, averages 15 miles in width between opposing embayments. This majestic crevasse varies from 3,000 to 6,200 feet deep, with the prevailing depth at just about one vertical mile.

Only six miles east of the Snake River in Hell's Canyon towers He Devil Peak, tallest goblin of the dark and somber Seven Devils Range. Its elevation totals 9,387 feet. The Snake is surging downhill at an altitude of 1,400 feet. This gives Hell's Canyon a maximum depth of 7,987 feet—and the title.

Monument Peak, 8,956 feet, and Devil's Farm, 9,068 feet, are on the same ridge. In addition, bluffs and pinnacles of at least 8,200-foot elevation loom still nearer to the Snake, some a trifling three miles away. These summits help to explain the impressive 5,500-foot average depth of Hell's Canyon for a distance of approximately 125 miles.

Are Peaks Part of Canyon Rim?

I've stood in the wooded saddle between He Devil and one of its horned satellites, and looked down into the dark canyon. This vista confirms the judgment of the Geological Survey regarding the depth of the great chasm trenched by the Snake. The summits of the Seven Devils are a definite continuation of the normal rim of the vast abyss.

As a veteran U. S. forest ranger in the

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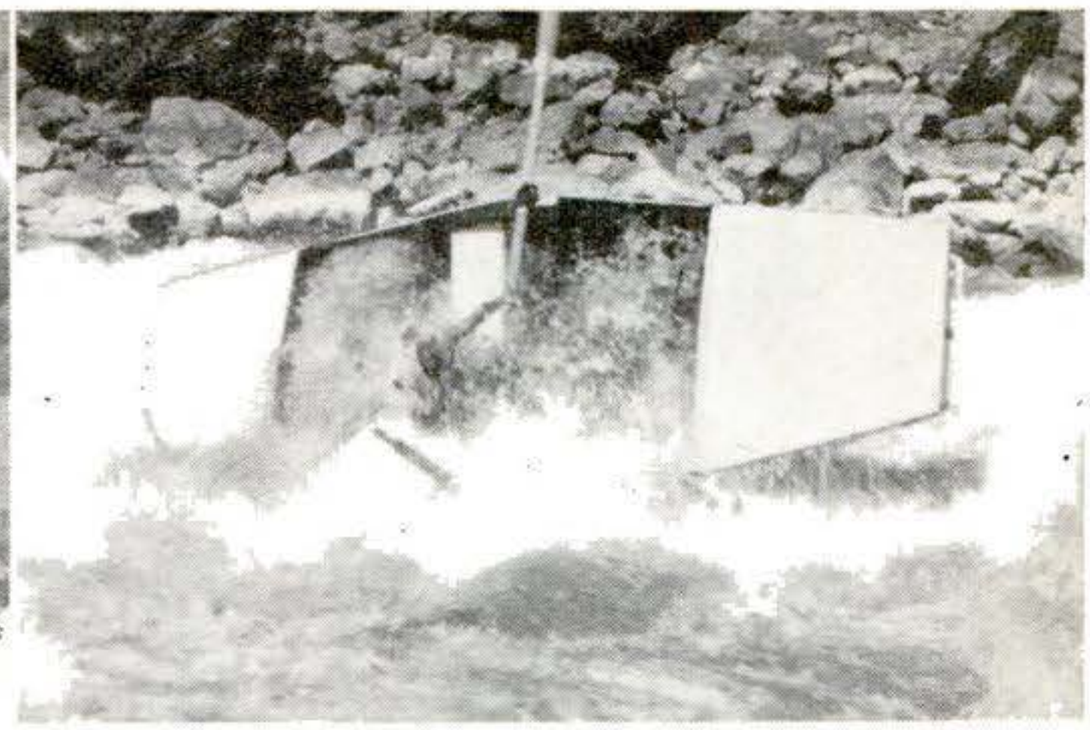
WOODEN BOAT enters rapids stern first to slow its speed as water sweeps it over rocks.



SUDDEN LURCH dumps boatman into Squaw Creek Rapids. Companions pulled him out.

fastness of the Nez Perce National Forest of Idaho, Glenn Boy, said to me:

"It's as legitimate to count the Seven Devils as part of the threshold of Hell's Canyon as it is to include the drop at Yellowstone Falls as part of the total downstream incline of the Yellowstone River."

That Hell's Canyon ranks as quite a ravine was the emphatic opinion of some of the brawniest and bravest citizens ever to roam our continent.

Lewis and Clark, first of all the Northwest pioneers, sought another route to Oregon when they saw the "miles of white water and snow-covered mountains" of the Salmon River Gorge, which unites with the Snake in Hell's Canyon. But the Pacific Fur Company expedition of 1811, sent by John Jacob Astor to find beaver pelts and build a log fort, paddled into the dark and gloomy defile.

It was a voyage of horrors. The best canoeist was sucked into a churning whirlpool and never seen again. Two more paddlers drowned before the splintered boats were used for firewood. The Argonauts staggered along on foot, with one of their number a maniac who shrieked and babbled for his home in far-off New York. Bluffs became so steep that they could not get down to the river for drinking water.

Ramsay Crooks, leader of the trek, and three of the strongest men tried to get out of the chasm. After a day of strenuous climbing they found they "were not halfway to the summit and that mountain upon mountain lay piled beyond in wintry desolation." At last they had to turn back.

Name Came Out of Somber Experiences

It was out of such tragic and somber experiences that the name "Hell's Canyon" came to have common usage.

Indeed, the names of America's two greatest chasms are singularly appropriate. The Grand Canyon is what the term implies—a vast gulf of brilliant colors

HOMESTEADERS Allan Wilson and his wife Hazel have a profitable sideline in hunting

Hell's Canyon cougars (right) for bounty. One day they bagged six—at $60 apiece.

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FLAT-BOTTOMED RIVER BOAT *IDAHO*, a 45-footer powered by twin 150-hp. diesels, carries U.S. mail to isolated settlers and prospectors along Snake River. Occasionally, boat must bring emergency feed to sheep and cattle on snowbound ledges.

and sublime dimensions. The wayfarer on the brink gasps at the spectacle before him, particularly the turreted battlements of red, purple, green and even pink rock. As the daylight changes, the hues of the canyon take on a new sheen. The tints change, yet always the overall vista gleams with magnificence.

Black Is Dominant Color

Hell's Canyon is grim and forbidding. The dominant color is black, a black modified only by an occasional rampart of somber slate-gray. Dark cliffs frown down on the river like outlaws' castles. The precipices absorb sunlight.

Even the names of satellites within the canyons symbolize the opposing moods. In the Grand Canyon buttes are known buoyantly as Shiva Temple, Zoroaster Temple and Cathedral Stairs. Hell's Canyon is stockaded gloomily by Freezeout Saddle, Purgatory Saddle and Black Point. The most celebrated promontory of the Grand Canyon is Bright Angel Point, while that of Hell's Canyon is He Devil Peak. Could any contrast be more complete?

Yet the only man in history who ever ran both yawning chasms alone told me many times that Hell's Canyon was a "far more hospitable abyss."

The late Haldane (Buzz) Holmstrom, who lived in the seacoast town of Coquille, Ore., took his homemade rowboats of Port Orford cedar through spray-spattered canyons as nonchalantly as most men wheel the family sedan to the corner supermarket.

At Green River, Wyo., where he started his descent of the Colorado River system in 1938, well-wishers actually tried to restrain him by force as he put out under the Union Pacific bridge. They feared he was as good as gone because the Colorado had yet to be conquered by a lone boatman. But 57 days later, Holmstrom rowed wearily toward the parapet of Hoover Dam on placid Lake Mead while a line of engineers held a banner which enthusiastically proclaimed: "BUZZ, YOU'RE ALL RIGHT!"

He Whipsawed Lumber for His Boats

This man who loved white water hurtled through most of the major chasms on the North American continent, voyaging in boats for which he had whipsawed his own lumber.

"You want wood that'll give and spring back rather than wood that will crack," said the blond Buzz, who came from a long line of Scandinavian seafarers. "You're bound to graze some boulders in a big canyon. Cedar, a poor wood for permanent purposes, will yield like rubber where a better grade of timber might splinter."

I still have the notes on Holmstrom's

[Continued on page 262]

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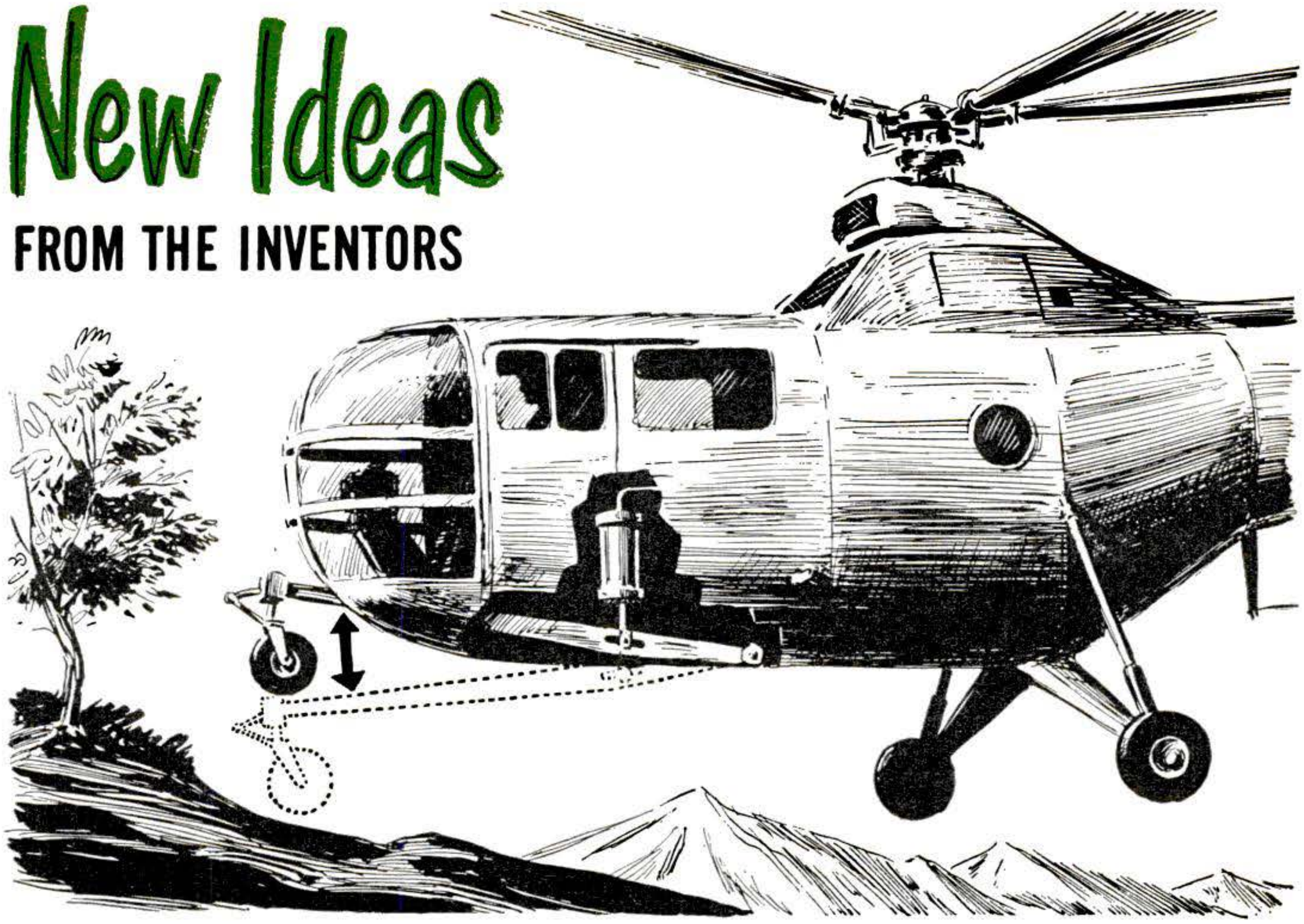
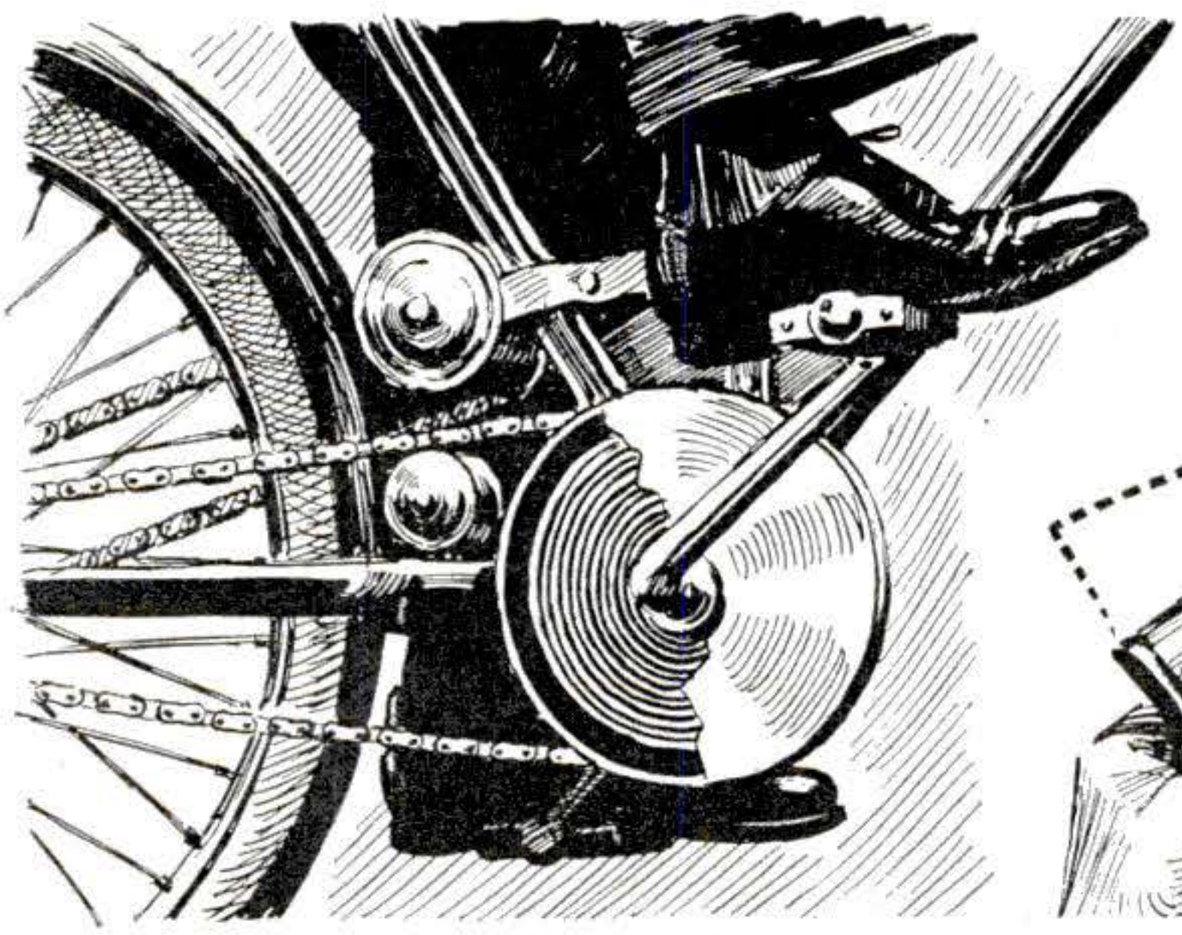
New Ideas

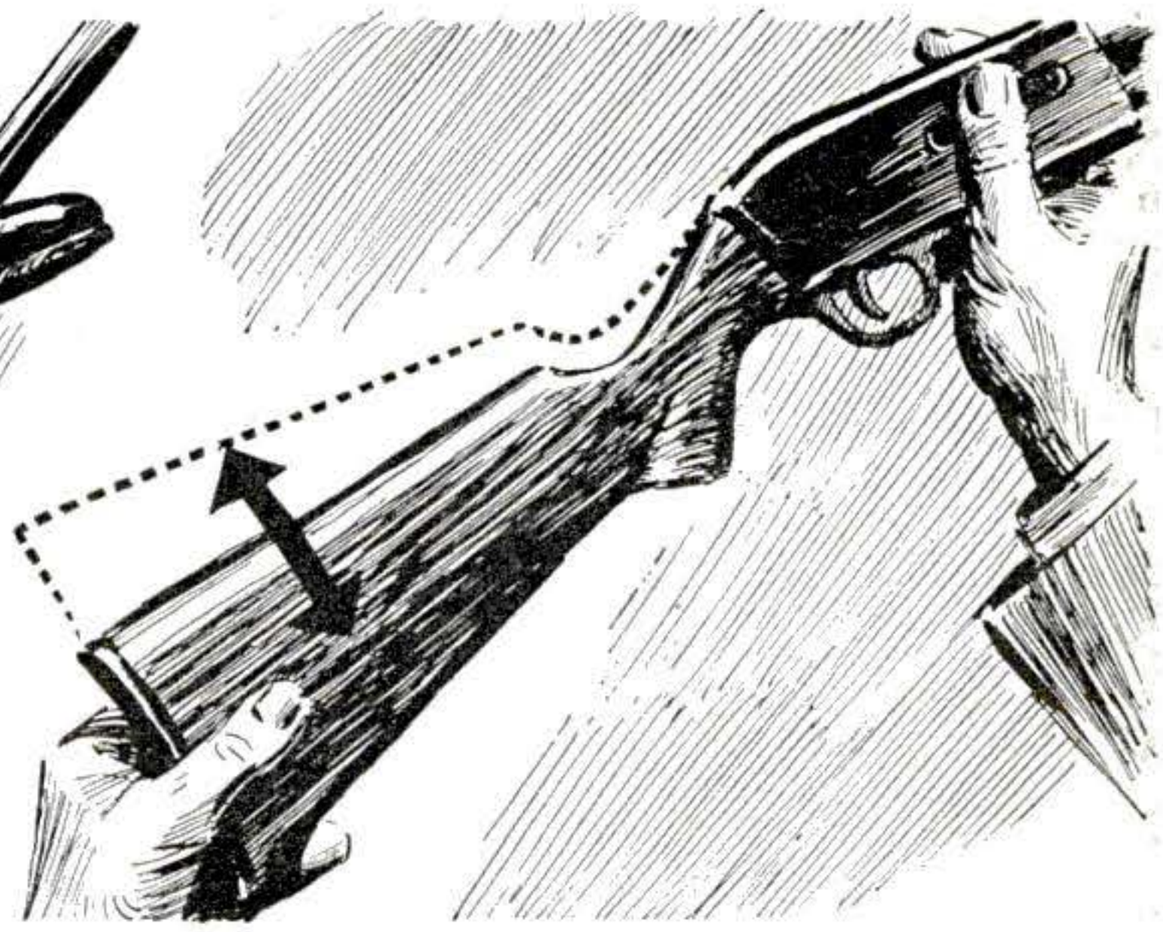
FROM THE INVENTORS



1 Copter to Land on Slopes. Igor Sikorsky, pioneer helicopter designer, has figured out a way to make the flying windmills even more versatile. He proposes self-leveling landing gear to permit the craft to alight on almost any terrain with fuselage level. To land, the pilot would head uphill and let the telescoping nose wheel find its own height. Setting down the main gear would lock the nose wheel.



2 Spring to Help Pedal Bike. You'd be pedaling downhill all the way if your bike had this booster spring attachment. As you pumped along an easy stretch or coasted down a grade, the momentum of the rear wheel would wind a spring attached to the drive sprocket. Energy stored in the spring would propel the cycle up the next slope.



3 Rifle Butt to Adjust to User. Orientation of a rifle butt, says this inventor, should conform to the shooter's body. This allows him to hold the gun safely and get an accurate sight. The design of this gun allows for limited horizontal and vertical adjustment of the butt. The user can quickly set it, then lock it in position.

Please turn the page for more new ideas.

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MORE New Ideas from the Inventors

4 "Pistol" to Polish Shoes. The kids would compete for the privilege of shining shoes if they could use this gadget. The gunlike kit would deposit polish on the shoe, then buff it down by a rotary movement of the brush. The brush would be driven through a pinion by the thumb-operated rocker arm. Reservoirs in the handle could hold different-colored polishes.

5 Musical Chair to Soothe Patients. Having your favorite tunes piped through the headrest of a dental chair could make your next drill-and-fill visit less unpleasant. A small earphone or bone-conduction sound reproducer recessed in the head support would help distract a patient and lessen his sensation of pain. The entertainment would also save the dentist's ears and rescue patients and dentists from their traditional one-way conversations.

6 Rescue Suit to Spray Itself. Protected by the spray of a fire-extinguishing chemical, a fire fighter wearing this outfit could walk safely through a blazing structure. The chemical, carried in a knapsack-type tank and pumped out through a nozzle atop the hood, would protect the suit and its wearer. Different chemicals would adapt the outfit for decontamination and rescue work in areas made unsafe by smoke, poison gas or atomic radiation.

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7 Gauge to Aid Photo Lighting. A photographer could save himself a lot of trial shooting if he had a gauge like this to help him find the right distances and angles for his floods and spots. The device would screw onto a standard tripod. Data with it would show the type, amount and placement of lights for typical shots.

8 One-Shot Packs to Fill Pipes. You could carry with you just as much or as little tobacco as you needed if your rough-cut came in single-filling cones like these. The moistureproof containers would keep the tobacco fresher, and you could fill a pipe easily and cleanly by pressing out the contents as shown.

9 Pedal to Signal Turns. Your left foot, relieved of driving chores in clutchless cars, will be put back to work if this GM patent comes into use. The turn-signal switch, operated by a rocking pedal on the left toeboard, would leave both hands free to manipulate the steering wheel.

10 Sofa to Open into Two-Deck Bed. Convertible sofa beds, designed to save space, could save even more if they were made this way. Opened or closed, this double-decker would occupy exactly the same floor area. Folded down, the top mattress would form the sofa's back rest.

U.S. patents on these inventions have been granted to: 1. Igor Sikorsky, Bridgeport, Conn.; 2. James Crumble, Brooklyn; 3. Giovanni Fantoni, Brescia, Italy; 4. James Pettie, Martinsville, Va.; 5. George La Fitte, Atlanta; 6. Ludwig Spandau, Arverne, N. Y.; 7. Charles Mallow, NYC; 8. S. L. Hirschhorn, Los Angeles; 9. Paul Schneider, Anderson, Ind.; 10. Johan Ekeberg, Oslo, Norway.

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Precut Lumber Starts Amateurs Building

Here's how amateurs are solving the housing problem with fewer headaches than most novices encounter.

By John L. Springer

TWO old high-school friends, Jack Jordan and John Murnane, met unexpectedly a few years ago in a New Jersey park. They were ex-GIs, married, with one child each, living in cramped apartments without enough money to buy a house.

So they agreed to tackle the housing problem together. For months, they questioned friends who had bought or built houses. And finally, although neither of them knew the first thing about carpentry or any other trade, they decided to build their own homes.

Their completed houses now stand side by side on 75-foot plots on Hillside Avenue in Springfield, N. J. They are good-looking Cape Cod cottages, each

The Alex Lauries of Morristown, N. J., shop for a home with salesman from lumber company.

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In Weyerhaeuser plant at Port of Newark, N. J., gang saw notches lumber for modular house.

with five rooms, bath, full basement and oversized garage. I examined them inside and out. They are as attractive as the average house erected by professionals, and they are constructed better.

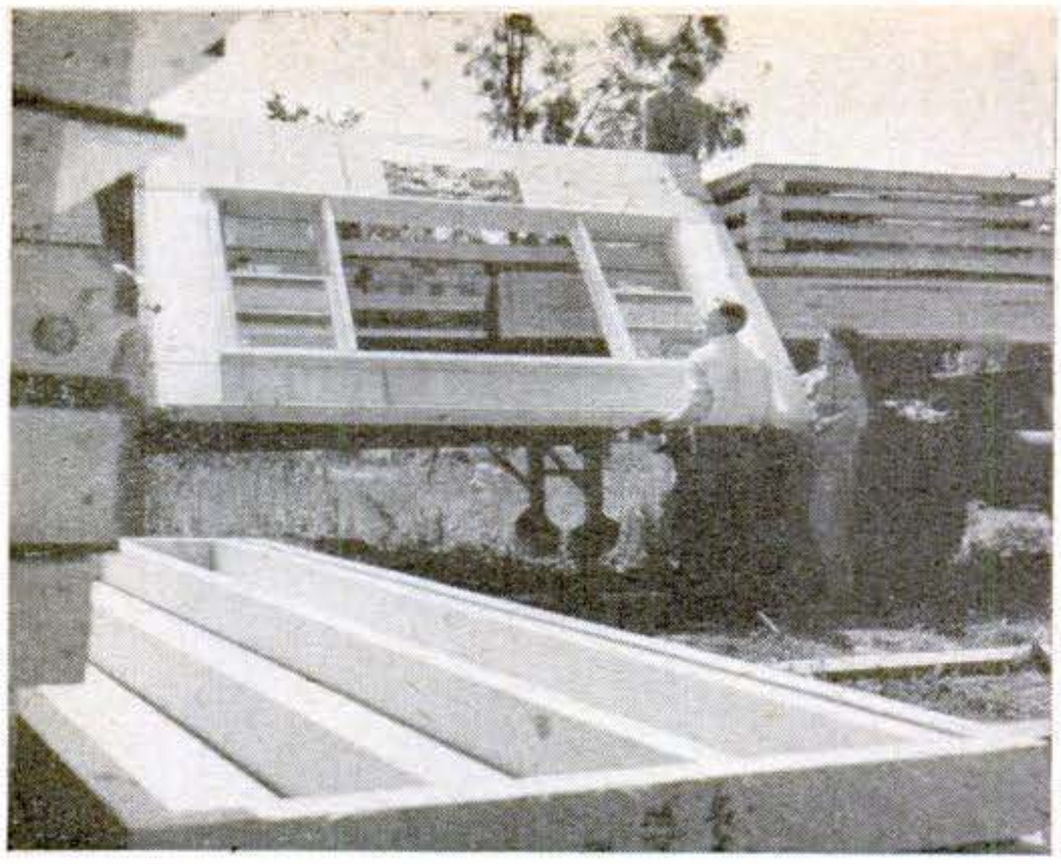
Modern Method Bars Mistakes

Thousands of other novices now are building homes on nights and weekends with similar results. They use a modern, streamlined method that makes it difficult, if not impossible, to make a serious mistake in putting the basic frame of a house together. The pictures on these pages show the actual progress in less than a week on another house put up the same way by young Alex Laurie, an automobile-accessories salesman at nearby Morristown, N. J.

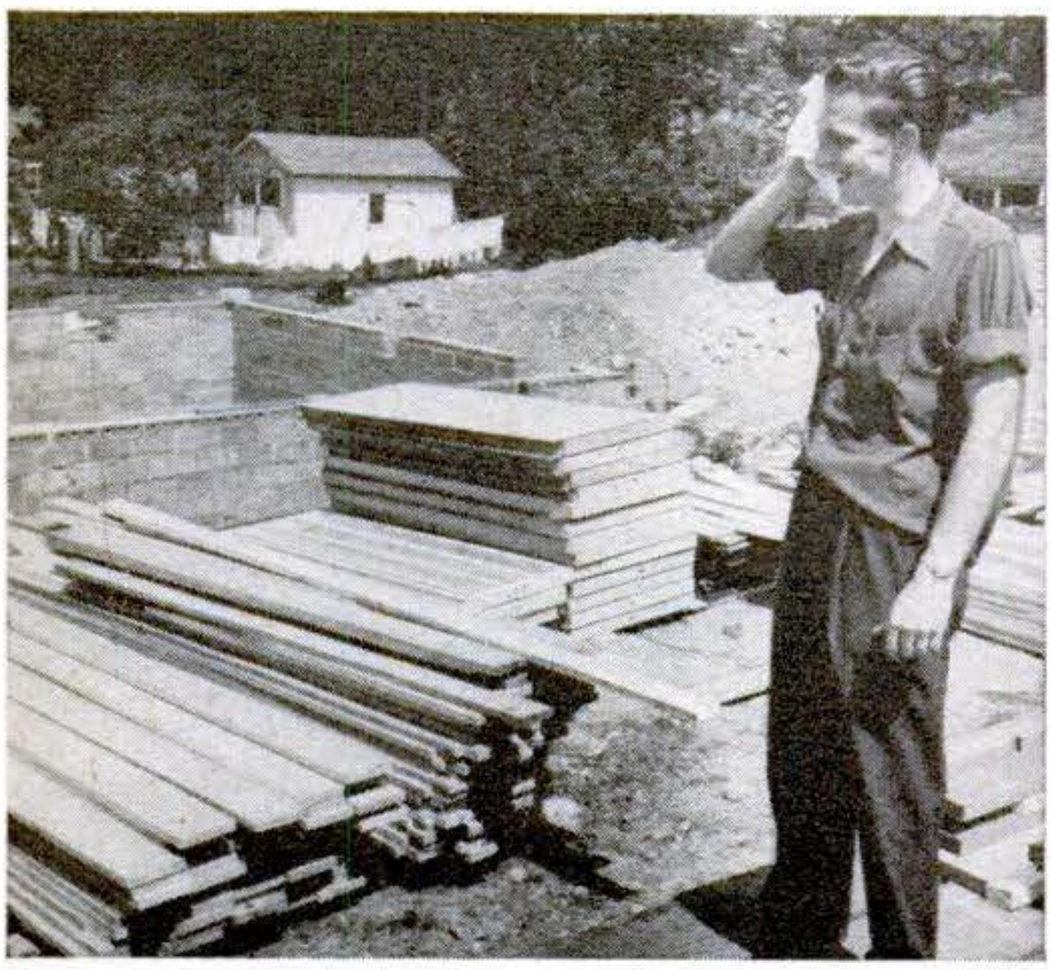
This is *not* prefabrication, but *precut* building. You select the house you want and order the lumber for it (in some cases through your local dealer, in others directly) from any of the dozens of specialists in precut houses throughout the country. Then, when you complete your foundation, all parts for the shell of the house are delivered together.

Each piece or section of lumber is

ENTIRE STRUCTURAL SHELL of six-room house, including windows and doors already hung, is delivered to site in one truck. Not included are such items as siding and flooring.



A WINDOW SECTION is unloaded from truck. In foreground are wall sections which come in four-foot modules. This reduces cost and increases flexibility of house design.



HOMEOWNER-TO-BE wipes his brow as he surveys knocked-down house. Package is complete. He won't have to trot back to lumberyard for more wood. He's no Mr. Blandings.

HOUSE IS STARTED. Floor joists are dropped into dadoes in sill. This not only assures accuracy but also adds to rigidity of frame. Joists go in as fast as nails can be driven.

coded. You get an instruction sheet telling which planks are for the sill resting on the foundation, which joists form the framework for the floors. You get subflooring, exterior wall panels, roof rafters. You simply nail or bolt the parts together, following printed, step-by-step instructions. Using only a hammer, you can erect what one distributor of precut houses calls "the finest homes you NEVER saw."

White-Collar Men Turn Builders

Jordan and Murnane bought precut parts for their homes through their local dealer, from the Weyerhaeuser Lumber Company, a national firm with a huge warehouse and plant in Newark, N. J. Wadsworth Homes, Inc., in Kansas City, Kan., and other firms in the West and Midwest offer similar deals. You probably can build a house at somewhat lower cost if you cut the lumber yourself, since you save on labor costs at the mill. But framing the house will take considerably longer—and the danger of costly errors is intensified.

Jordan is a department supervisor for the Prudential Insurance Company in Newark, and Murnane is a special agent of the Pearl Assurance Company there. Both are five-day-a-week white-collar workers. They erected their homes by working nights, weekends and during vacations. Since neither knew how to frame a house, they had to find the most economical way to erect the shell. And since time was limited, they had to get it up fast so that they could work inside regardless of the weather.

Keep Foundations On the Level

The ex-GIs hired a bulldozer operator to dig their foundations. They staked out the forms for the footings themselves, then bought ready-mixed concrete to fill them. They hired a mason by the day to lay the cinder-block foundations and worked as his helpers—making sure that the warning stressed by all sellers of precut houses was heeded: *the foundation must be true, square and level,* because unlike wood cut on the job, precut lum-

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END GABLE is tipped into place. It exactly spans width of three four-foot wall sections.

Modular units come either solid or with windows or doors already built into them.

ber cannot cover up an amateur mason's mistakes.

They ordered the lumber for one house delivered on the Saturday they both began a week's vacation. With two friends helping, they unloaded the truck in three hours. By Saturday night, they had the two-by-10-inch first-floor beams nailed in place, the subflooring (four-by-eight-foot sheets of ⅝-inch plywood) down and nailed, and the exterior wall panels up and in place.

Wall Panels Are Spiked Together

Weyerhaeuser's panels consist of conventional two-by-four framing covered with 5/16-inch plywood sheathing. The panels usually are four feet wide and you simply spike them together. Windows and doors are prehung in similar panels:

RIDGEPOLE GOES UP. Saw cuts, showing where rafters are to be nailed, eliminate measuring. In three and a half days four nonprofessional workmen have erected rest of frame.

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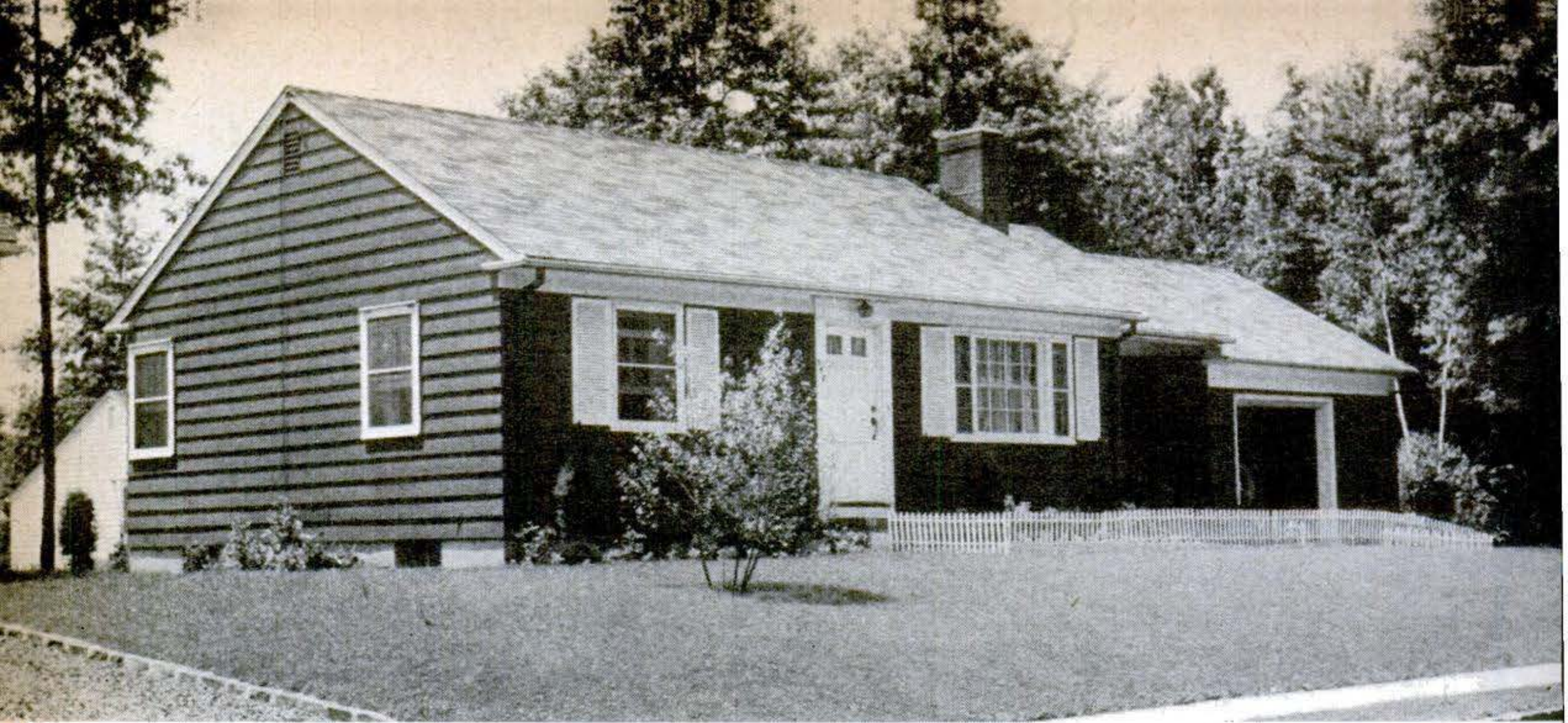

A PRECUT HOUSE looks like this after a family moves in. Structurally stronger than conventionally built dwelling, it can reflect individual design of custom-built house.

blueprints tell where each one goes.

Next, Jordan and Murnane began to frame the ceiling. The weight-bearing girder running through the ceiling in the center of the house, and the two-by-eight planks resting upright atop the exterior panels to box in the perimeter, all were notched slightly. Once they were in place, the builders simply put the ceiling beams in the notches and spiked them in place. Framing the roof was equally easy: notched ridgepole and rafters fitted together like a four-year-old child's jigsaw puzzle.

By the end of their week's vacation, Jordan and Murnane had the entire house closed in, roof shingles on, all windows and doors in place and prime-coated, and the brick fireplace completed. Not a minute was lost to weather.

Breathes there a man with mind so bright
He's replaced the socket on a light,
Then didn't loudly fret and yap
He hadn't put the cord through the cap!

Only a Half-Bushel of Waste

Perhaps equally remarkable, to those who often see conventional builders waste hundreds of dollars in sawed-off lumber, was their discovery that all the waste, when both houses were completed, only half-filled a small bushel basket, and that was due to a minor change they had made themselves!

As they worked together, moving from one house to the other, Jordan and Murnane learned that many "impossible" jobs are easy with professional help.

Fitting clapboards around a corner, for example, calls for a careful mitered cut done by hand and at an angle, since the bottom of the clapboard is thicker than the top. The partners paid a carpenter to start the job. They watched carefully and made numerous cuts under his supervision. Then they were able to finish the project themselves.

They hired a plumber, electrician, plasterer, tile man and oak-floor expert to do their specialized jobs. They stapled the insulation in place and after a little practice installed all the interior trim. Their wives did all the painting and paper hanging.

After a bulldozer pushed the topsoil back into place, they seeded the lawns and landscaped the grounds themselves.

"We had to work hard," Jordan says. "For about nine months, we missed only two nights and never a weekend. But we always knew what we were doing and where we were going. I wouldn't hesitate to build another house this way."

[Continued on page 250]

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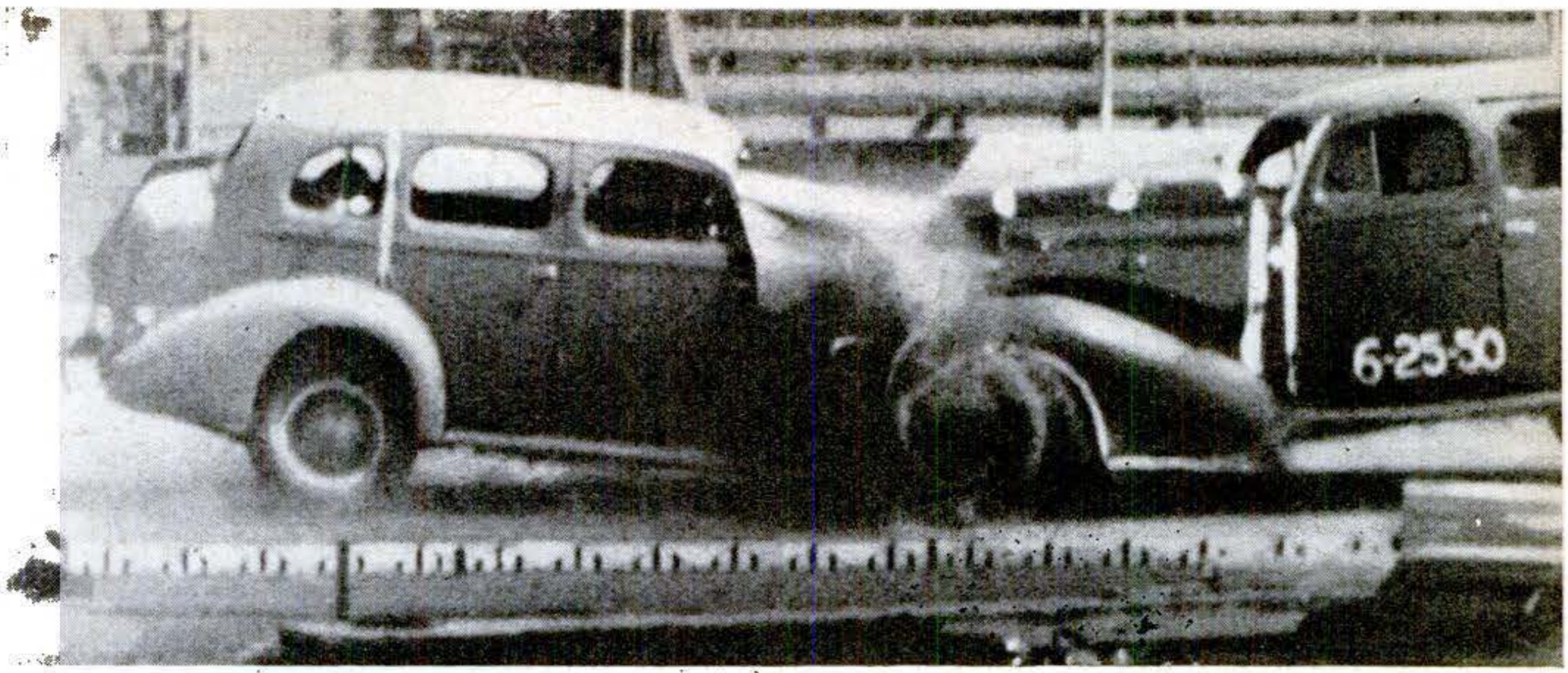
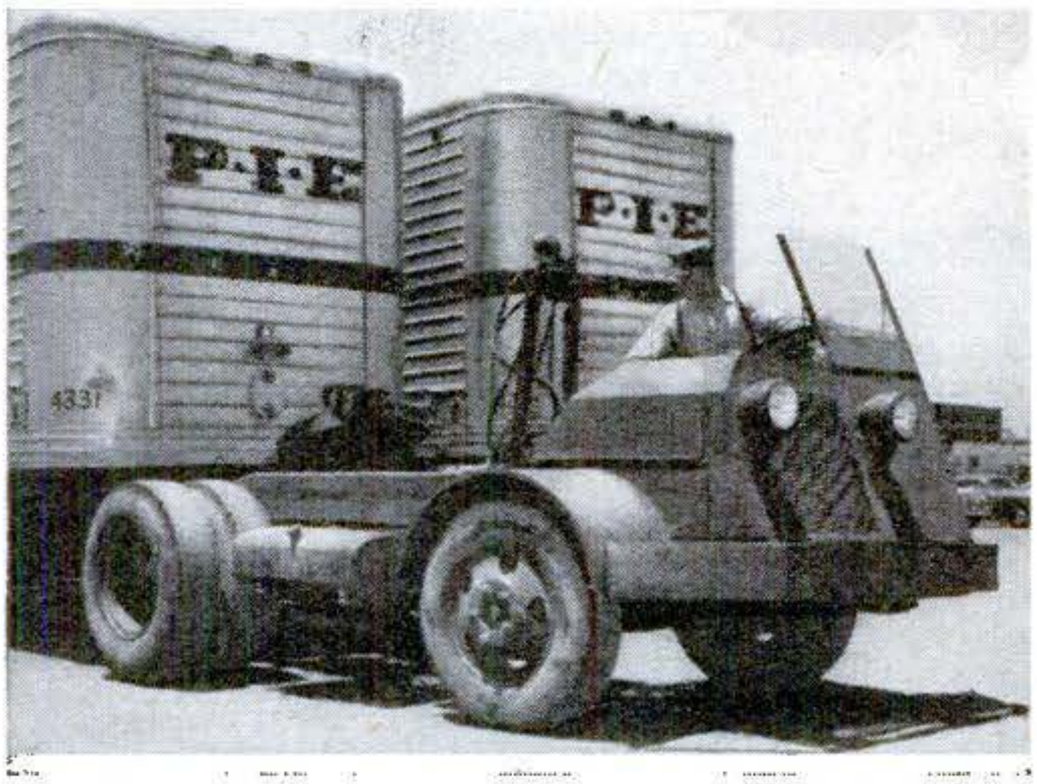


Daredevil Drivers Crash Head-on for Science

WHAT happens when two cars traveling at 37 and 23 miles per hour meet head-on? Two drivers staged the crash above to help the University of California safety researchers find out. The faster-moving Olds shoved the heavier Buick backward briefly during the 12/100-second crash. The Buick ground to a stop at a rate of 392 feet a second, the Olds (at left, after crash) at 421 feet a second. Both front ends were crushed in 2.6 feet. What about the drivers? They steered from the rear seats, dropped behind the front seats just before the smash and walked away with only a few bruises.



Switch Engine Moves Trailers

YARD donkeys jockey loaded trailers around freight yards of the Pacific Intermountain Express. As the donkey, powered by a Ford V-8 engine, is backed under a trailer, a hydraulically raised "fifth wheel" engages the trailer coupling and locks on.

Sports Announcers Ride High

BRITISH broadcasters covering outdoor events get a good view over the heads of the crowd from this strange-looking vehicle. Devised by BBC, it's an Austin eight-seater with a turret added. The glass-sided observation post is said to be almost soundproof.

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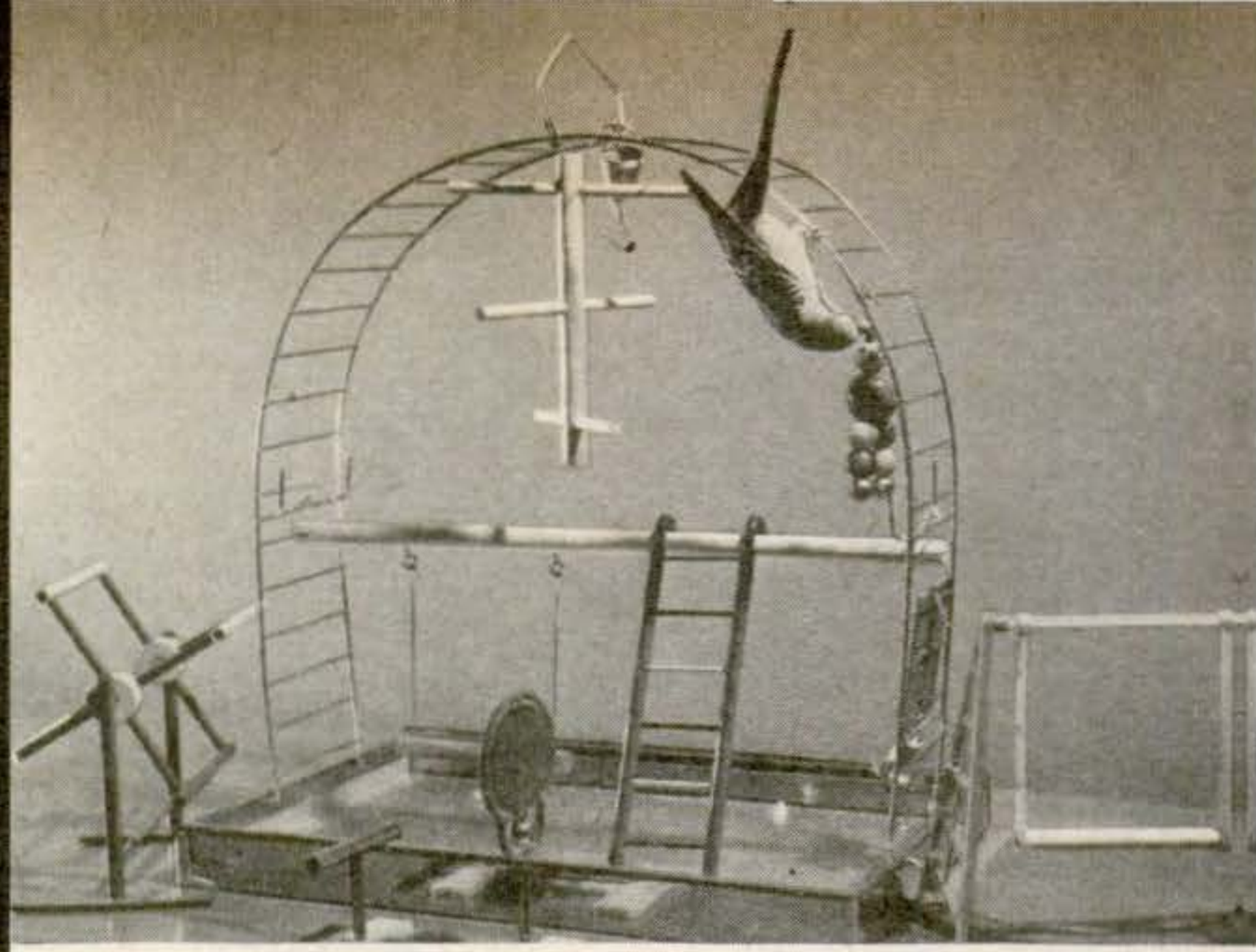
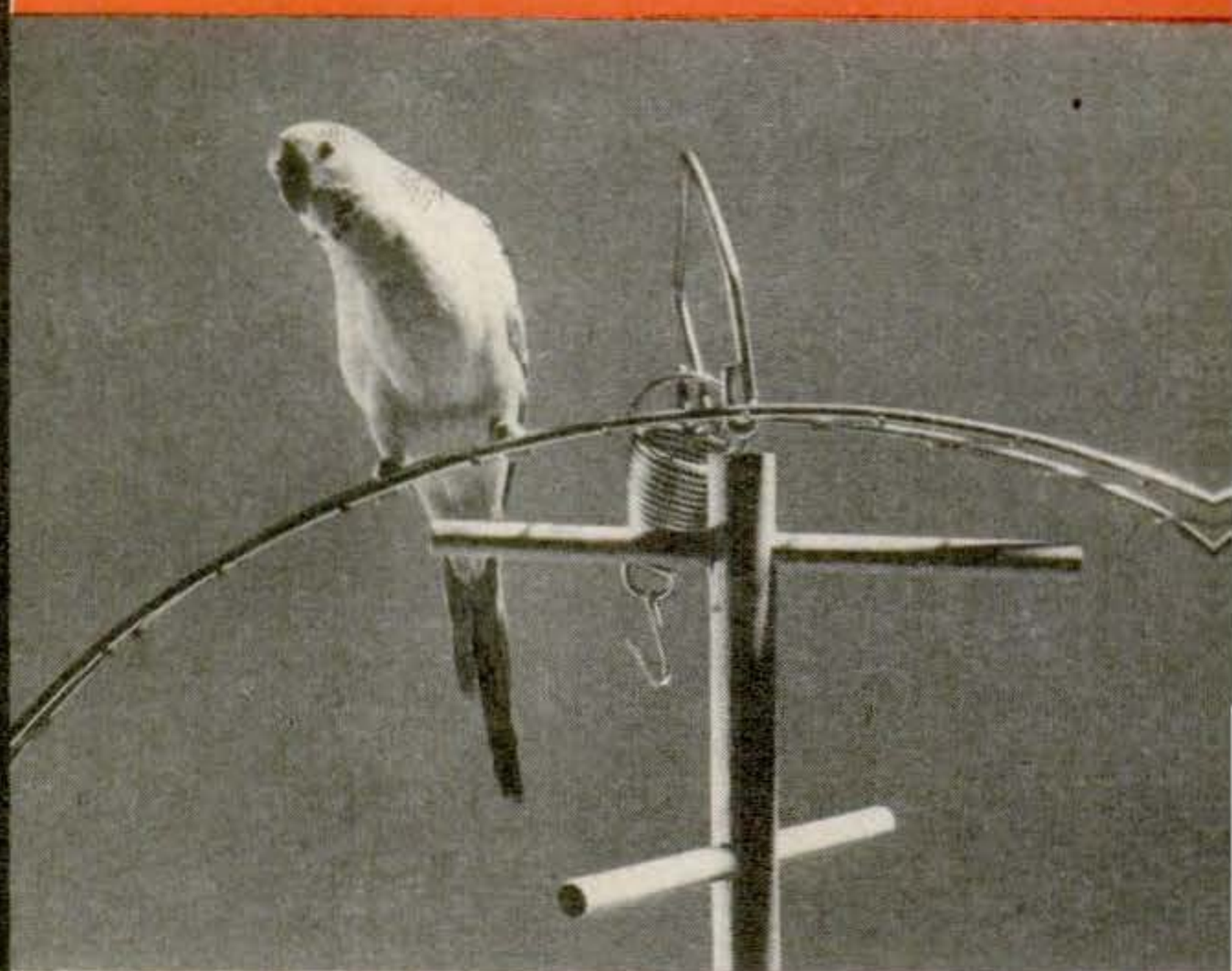
PARAKEETS WITH COLOR MUTATIONS like these will sell for $30 and up.



"MRS. MICAWBER," pictured less than life-size on facing page, does acrobatics on "playground" equipped with plastic toys.



ENJOYING FULL RUN of the author's home, Mrs. M. pauses to eye a visitor quizzically.

WILBUR CRANE, breeder of birds in picture below, exhibits a "finger-tame" parakeet in his home aviary.

AVIARY PINWHEEL, home-built by Crane, consists of circular wood frame, dowels, a bolt for axle and screen-door braces for spokes.

Pin Money from Parakeets

Sassy and talkative when properly trained, this little comic of the parrot family can be bred successfully in a one-room apartment.

By Devon Francis

FELLOW I know gave me a brand-new switch on parakeet stories the other day.

Seems that a housewife was sweeping the inside of her parakeet's cage with a tank-type vacuum cleaner. Suddenly the bird disappeared. A moment later the woman heard a muffled voice inside the tank. It was saying, "Get me out of here, get me out of here!"

You can believe that or not. I do. I'm willing to believe anything about parakeets. You see, I own a brace of these miniature talking parrots myself. There's no telling what they'll say. Or what they'll do, for that matter.

They're born comics. Any home with a parakeet has its own 24-hour burlesque show. They're perfect mimics. They sing. They whistle. Leave a parakeet in the same room with a canary, and in a few weeks you can't tell without looking which bird is warbling.

That's the reason everybody's breeding them. The demand for parakeets—also called budgereegahs or "budgies"—has grown so much that lawbreakers are smuggling parakeets into this country from Europe. They ship them in by plane under bond, fly them to Mexico and sneak them across the border.

It's illegal to import parakeets, and thereby hangs the tale of pin money from parakeets.

Anybody can breed parakeets. Got a 10-room house and 40 acres? You can raise parakeets. Got a one-room efficiency apartment? You can raise parakeets. Money? The going price is all the way from $8 to $100 apiece and up.

It doesn't even take patience to breed

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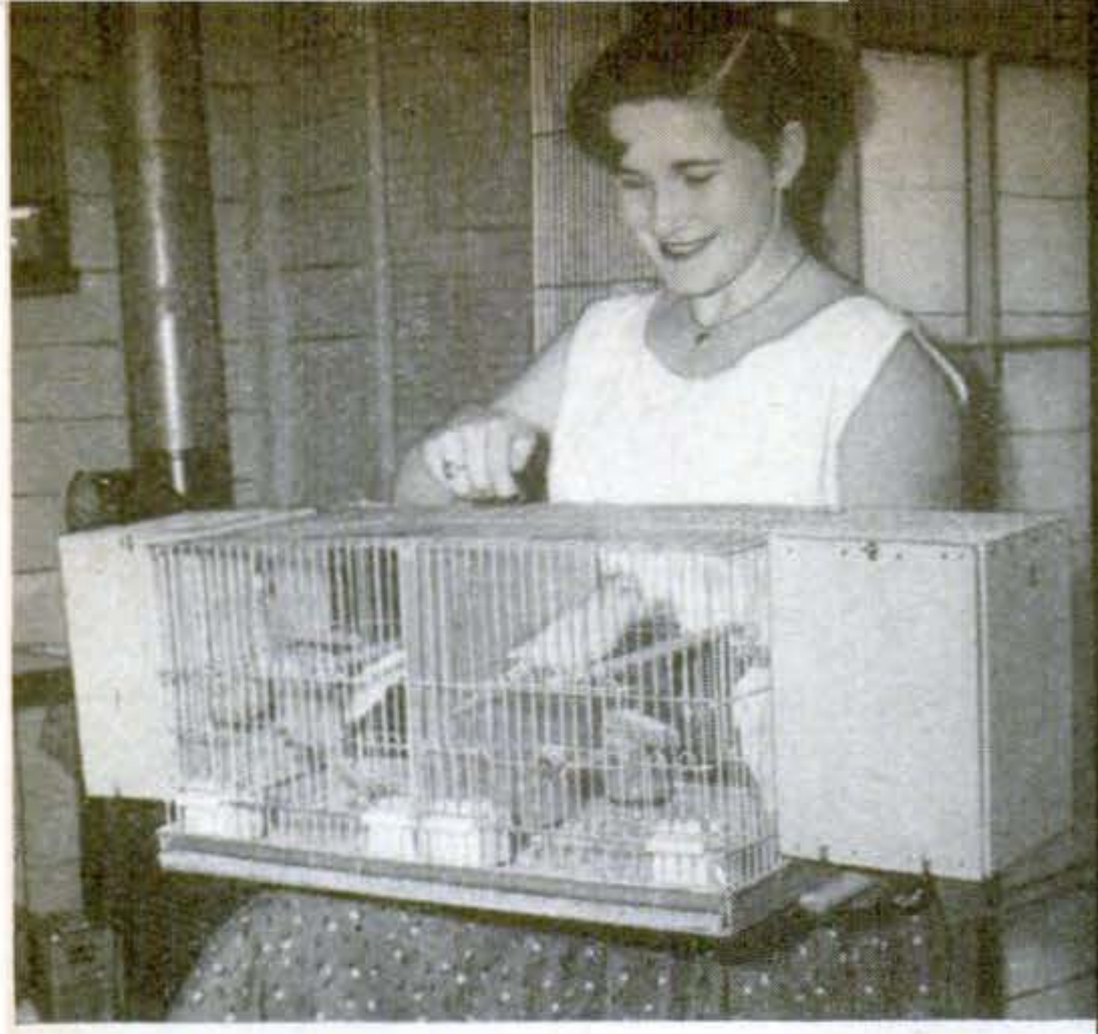
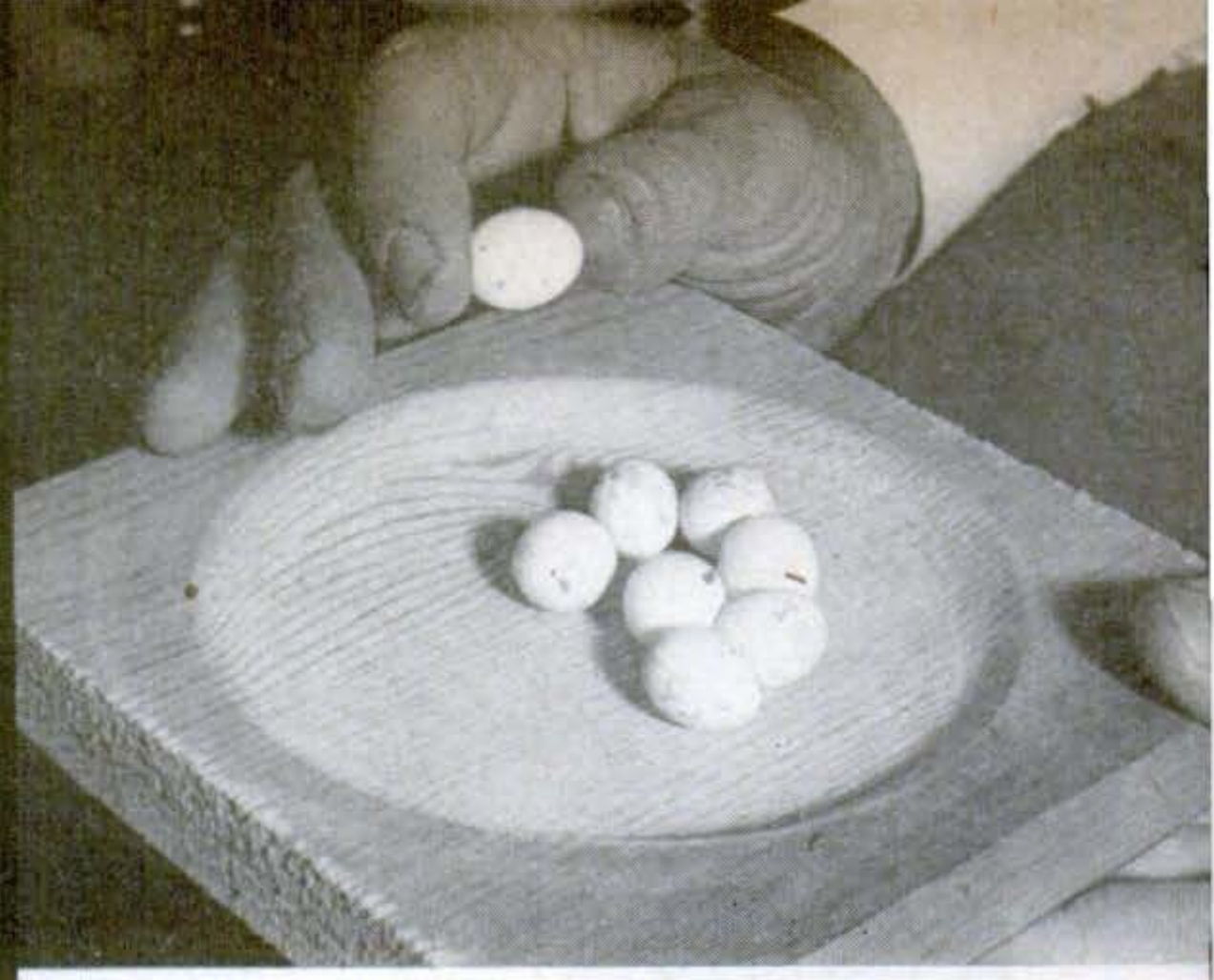


DOUBLE BREEDING CAGE, with nest boxes at ends, has metal partition in center to separate two pairs of birds. Holding it outside aviary is Sue Crane, 17.



NEST IS NOTHING but a hollowed-out piece of wood at bottom of nest box. Eggs, pure white, can be handled without damage if they don't become chilled.

parakeets. The chances are that four weeks after you introduce a pair to each other, they'll be feeding their fledglings with regurgitated milk and occasionally giving them a bilious eye. The parents have another clutch of eggs on their minds and the current crop of young is in the way.

You can skid into parakeet-breeding without really intending to. Listen to a few parakeet stories, and brother, you've had it! Like the one about the man walking along the street minding his own business when suddenly he heard a voice at his ear. It said, "My name's Timmy, and I live at 463 Columbus Avenue."

Hearing Is Believing

Don't believe it? Neither did I until my wife and I visited her Aunt Kappie in Detroit a few months ago.

"Listen!" commanded Kappie.

A small voice was saying, "My name's Toby and I live at 15444 Fairfield."

That was our introduction to parakeets. My wife had to have one. We got one. We've just bought a mate. Now we're waiting for our first clutch of eggs.

Parakeets wreck the routine of a house. A bird gets droopy, you rush it to a vet.

"It's like having children," remarks Wilbur Crane, a small-time breeder who lives in Pelham, a New York suburb. "A woman called me up the other day, crying. Told me her parakeet was sick."

That's the way you get. Alan Hinton of New York, the world's biggest dealer in parakeet supplies, cages and feed, tells about the businessman who arrived at his office to find his whole staff in a state of nerves. He heard the bad news before he could even get his hat off. His wife had telephoned. She was in hysterics. Their parakeet was missing.

He walked over to the hat rack, took off his hat, and there sat the parakeet on his head.

Pet parakeets are house birds. They're always on your head or shoulders. As regular as clockwork for months, when my wife did the morning dishes, Mrs. Micawber—our turquoise-blue female—perched on the spigot and sassed her.

Mrs. Micawber isn't doing that any more. She's quiet and thoughtful these days. She's got other things on her mind.

For firsthand information on parakeet breeding, I went to Wilbur Crane. He's typical. In charge of the hardware department at Sears, Roebuck in nearby White Plains, he has been raising birds on the side for years.

First he did it in the house. Then he built a small aviary in the back yard. He also has strawberry finches, Brazilian cardinals and other exotic birds, but the parakeets are his favorites. They're dependable.

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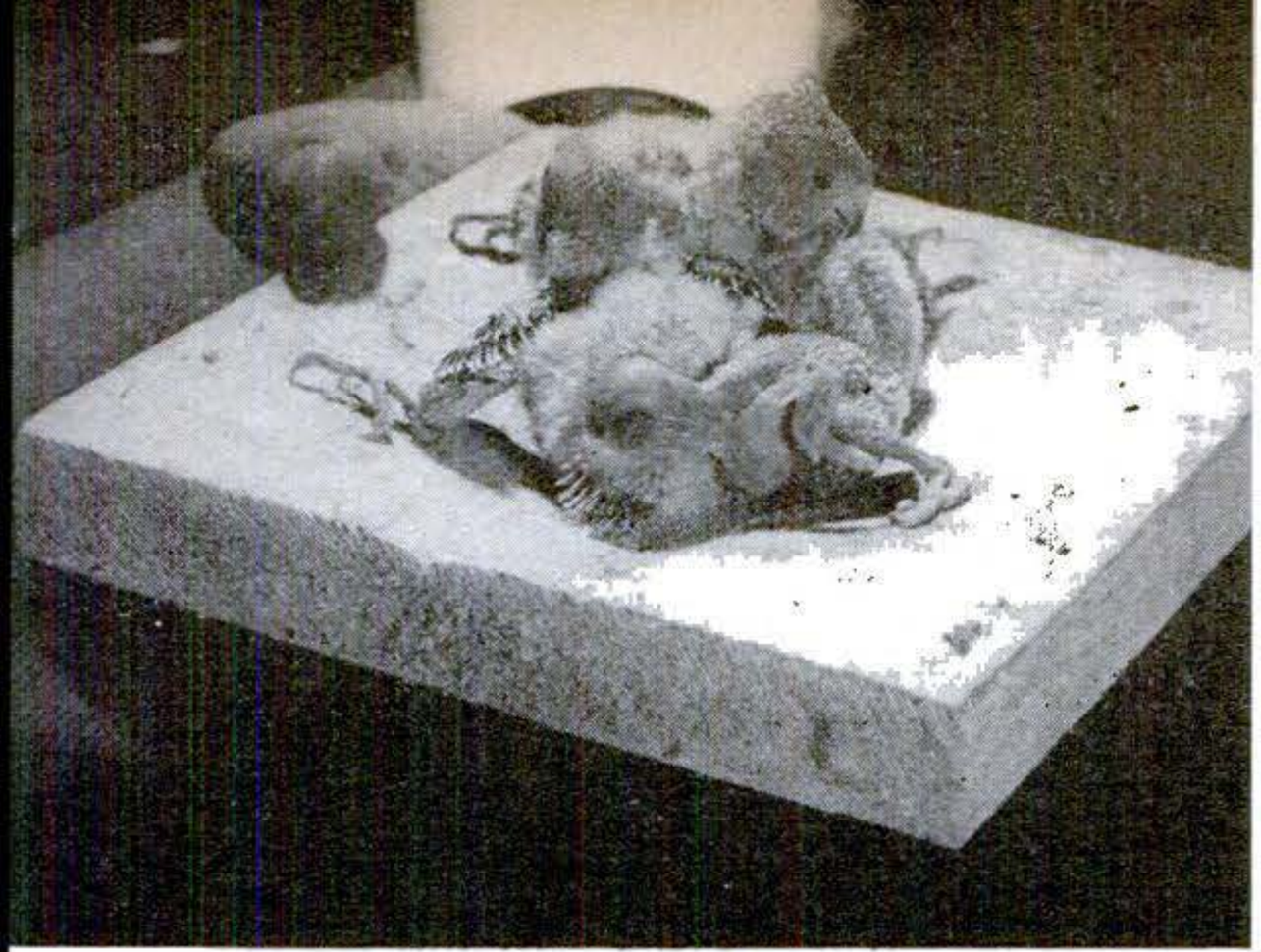


FLEDGLINGS GROW FAST. **Little fellow in foreground is eight days old, one in center about two weeks. Adult males can be bred for 10 years, females for five to six.**

BOTH male and female parakeets can be taught to talk with equal facility. Will Gerber of New York City, who has sold more than 200,000 copies of his authoritative treatise, *The Parakeet Owner's Handbook*, says a clutch will yield about two-thirds females and one-third males. "Rares" (mutations) will run about 75 percent females, however. Breeders who want customers to be satisfied with the talking proclivity of their birds will not sell a fledgling that is more than six weeks old. The average life of a pet is a dozen years; many have lived to the age of 15.

You lose canaries. Sometimes the parents won't feed them. But not parakeets. The parenthood urge in a parakeet hen is so strong that often she will lay eggs without a mate around. They're not fertile, of course, and won't hatch.

All you need for breeding is a cage and an attached nest box. The box has a hollowed-out block of wood in the bottom to take the eggs. Unlike canaries, parakeets don't build nests.

Egg Takes 18 Days to Hatch

Six to eight days after you introduce a male and hen, the first egg appears. The hen will lay an egg every other day for a clutch of five to 10. Eighteen days after the first egg is laid, a baby hatches. Hatchings occur in the same time-sequence as the layings, every other day.

The first food the fledglings get is the milk, known among bird fanciers as "pigeon's milk." Gradually the regurgitated food fed the young becomes more solid until they can eat on their own.

Be careful to take the young out of the nest in time. Otherwise, their elders start dispossession proceedings. The fledglings squawk their heads off. Jealousy, probably.

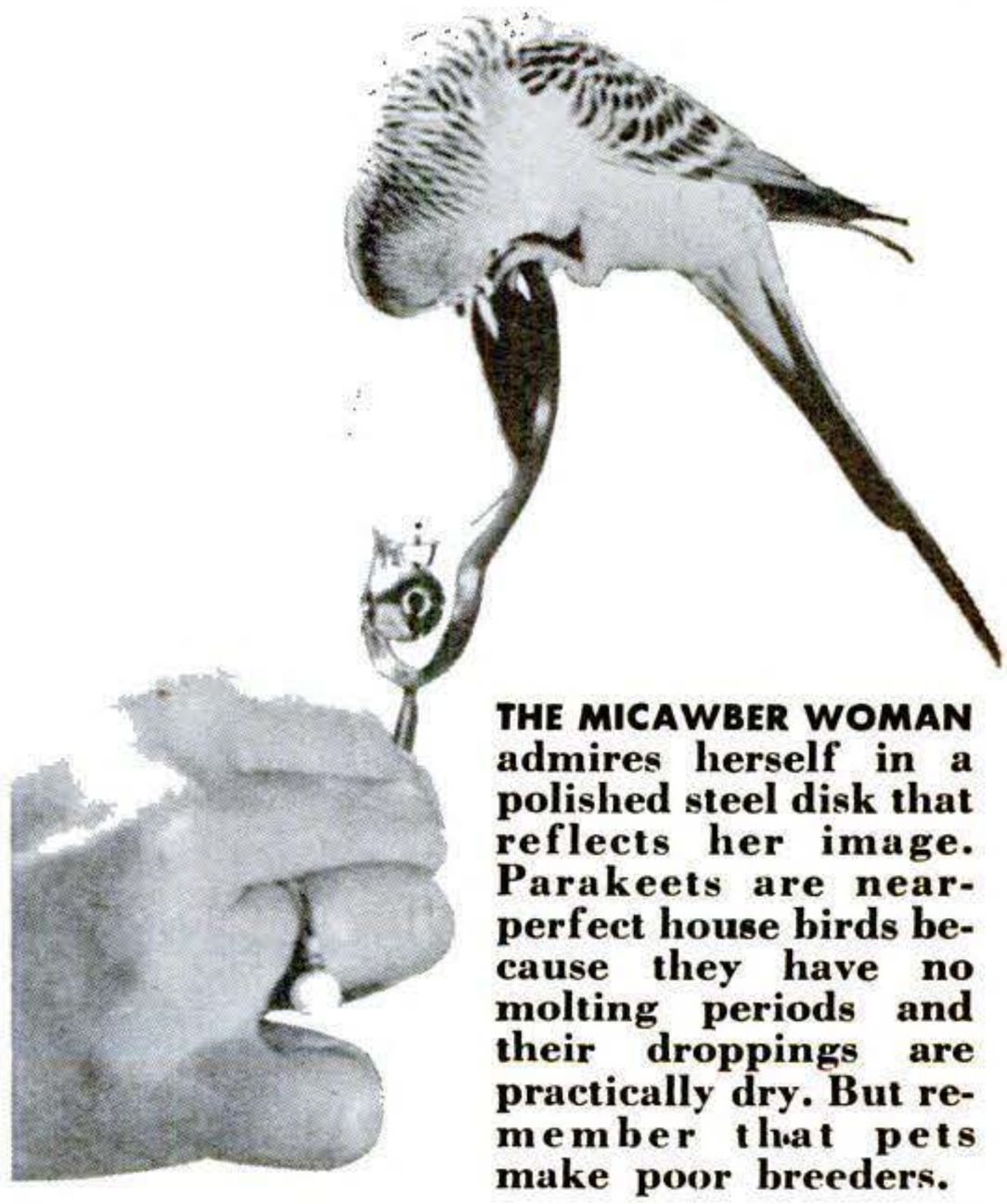
Parakeets are hardy. They can be left out all winter. But if you're going to breed in cold weather, build an aviary and install a stove to be sure of 50° heat for the young. There are a few don'ts on breeding parakeets:

Don't fail to provide more than enough nests if you put several pairs in one cage. Otherwise the females will wrangle like fishwives over the boxes.

Don't let a male and female quarrel too long after introduction. Sometimes they get snappish with each other over who owns the cage. If you put a wire partition in the cage, they'll make up.

Don't fuss about the food. Crane says

[Continued on page 254]



THE MICAWBER WOMAN **admires herself in a polished steel disk that reflects her image. Parakeets are near-perfect house birds because they have no molting periods and their droppings are practically dry. But remember that pets make poor breeders.**

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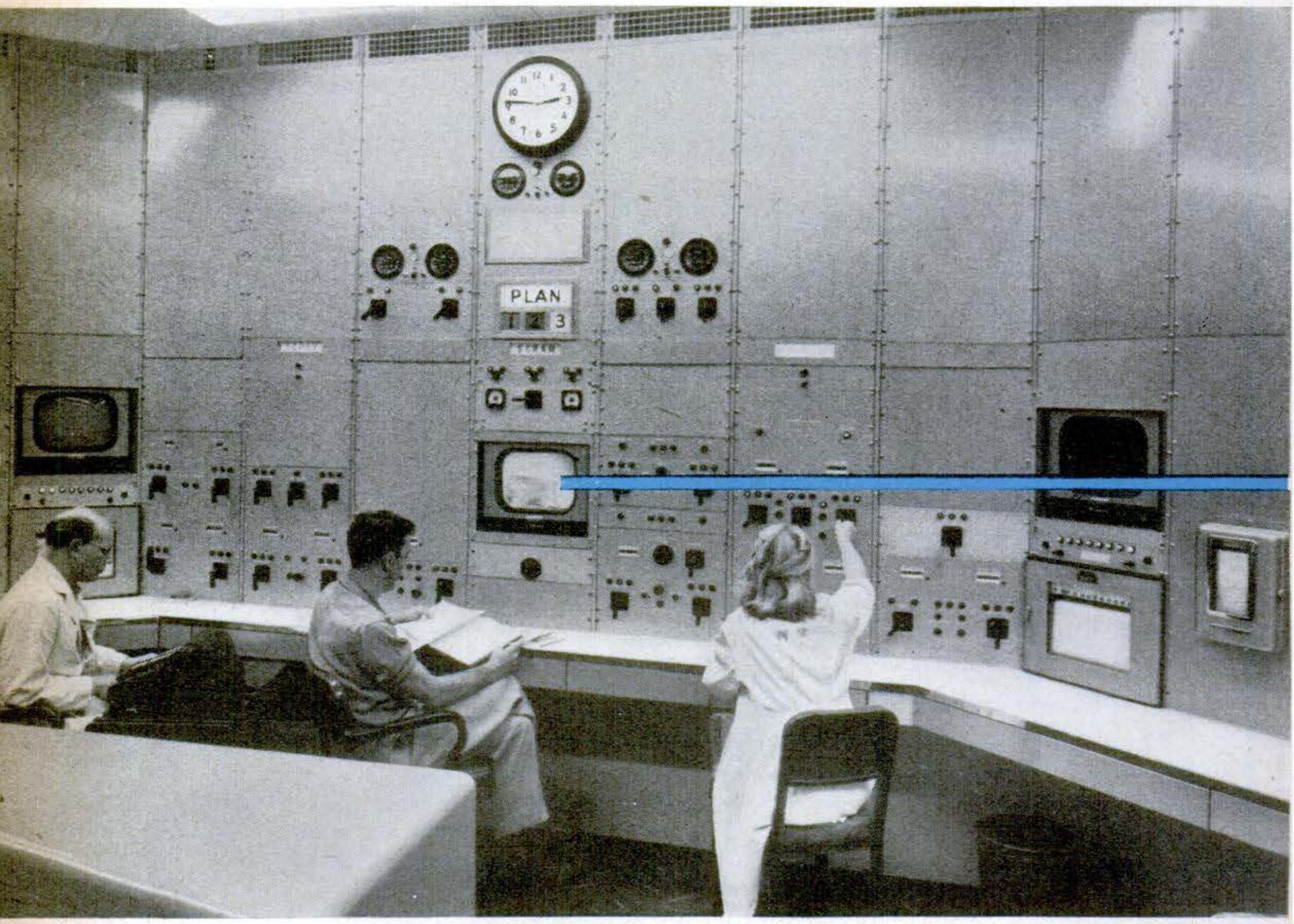
Watching at a safe distance, on TV, Los Alamos experts see what happens when they operate novel chain-reaction machines.

TAMING wild animals seems humdrum in comparison with bold Atomic Energy Commission experiments, currently under way, at the Los Alamos Scientific Laboratory in New Mexico. Here, experts are teaching tricks to a pair of near A-bombs, and watching the performance by TV from a quarter-mile away.

The "bombs" are two machines called Topsy and Godiva. Each, the AEC says, contains "enriched fissionable material"—presumably, uranium 235 or plutonium—in separate pieces, all of less than the "critical" or minimum size needed to cause a chain reaction. Remote-controlled pistons "assemble" or bring together the pieces. Then their combined mass exceeds the critical size, and a chain reaction takes place. This exactly duplicates, in slow motion, the way a detonator explodes an A-bomb.

Topsy and Godiva, however, have controls that hold the chain reaction in leash, and keep it from running away as it does in an A-bomb. So these controlled "bombs" are really fast reactors, or atomic piles, of a most unconventional kind.



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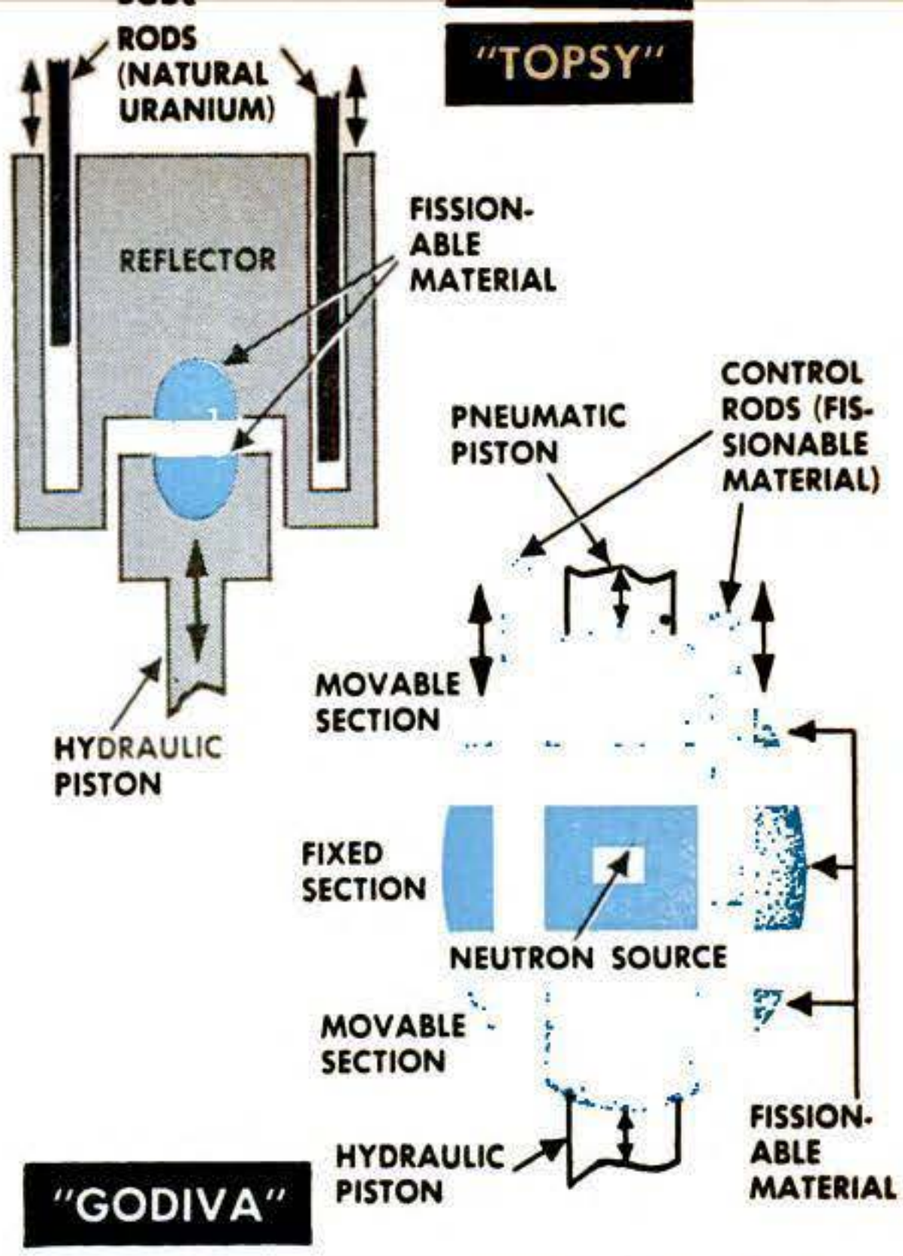
They have no protective shielding whatever, nor need it—they are in an isolated area, and are observed by television at a safe distance from their deadly rays. They lack cooling systems, too.

These simplifications permit experiments impossible with ordinary reactors. Object of some tests is to learn the precise amount of fissionable material that is "critical," when assembled in various shapes. Other tests measure effects of introducing foreign materials.

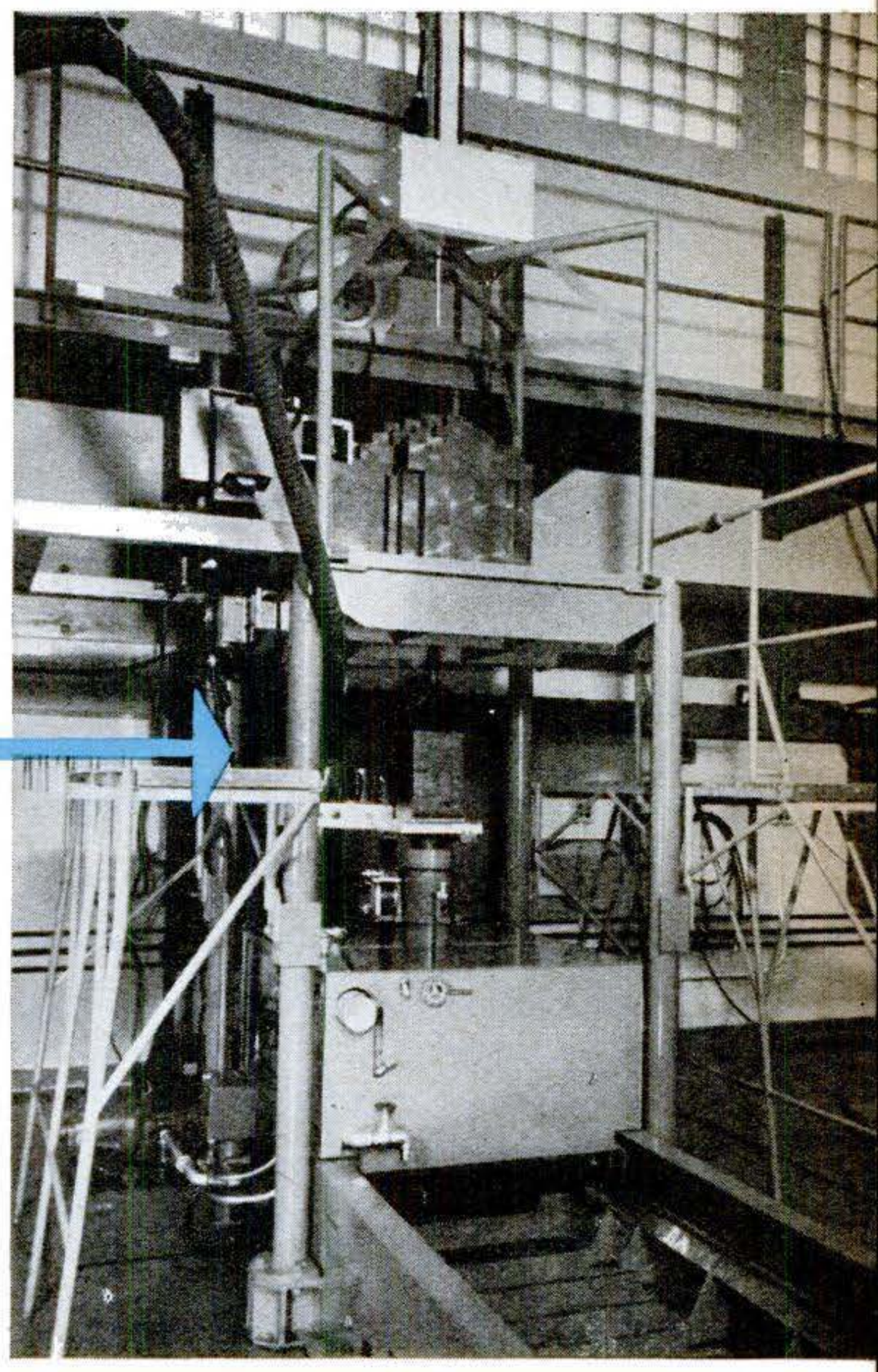
Like its fictional namesake, Topsy "just growed," from the experts' ideas. It forms a chain-reacting assembly within a rectangular block of neutron-reflecting material. Godiva takes its name from its lack of such a reflector, making it in technical language an "unclad" reactor.

No Danger of Atomic Explosion

There would be no atomic explosion if safety devices failed and a chain reaction ran away, for lack of anything to hold the reacting mass together long enough. But heat could vaporize the whole apparatus and loose a radioactive cloud, dangerous if it drifted toward observers. Hence, their quarter-mile distance, which would give them time to flee to safety.—*Alden P. Armagnac.*



TOPSY AND GODIVA work like this. In each, after principal pieces of fissionable material are assembled, inserting control rods makes assembly "critical" or chain-reacting.



TELEVISION SCREENS show experimenters, in observation building (left), results of working distant reactors' remote controls. In Topsy (right), hydraulic piston raises one piece of fissionable material against another in reflecting housing overhead. Inserting natural-uranium control rods then boosts reflecting effect to start chain reaction. If accident released radioactive cloud, observers could escape before it reached their quarter-mile-distant building (diagram).

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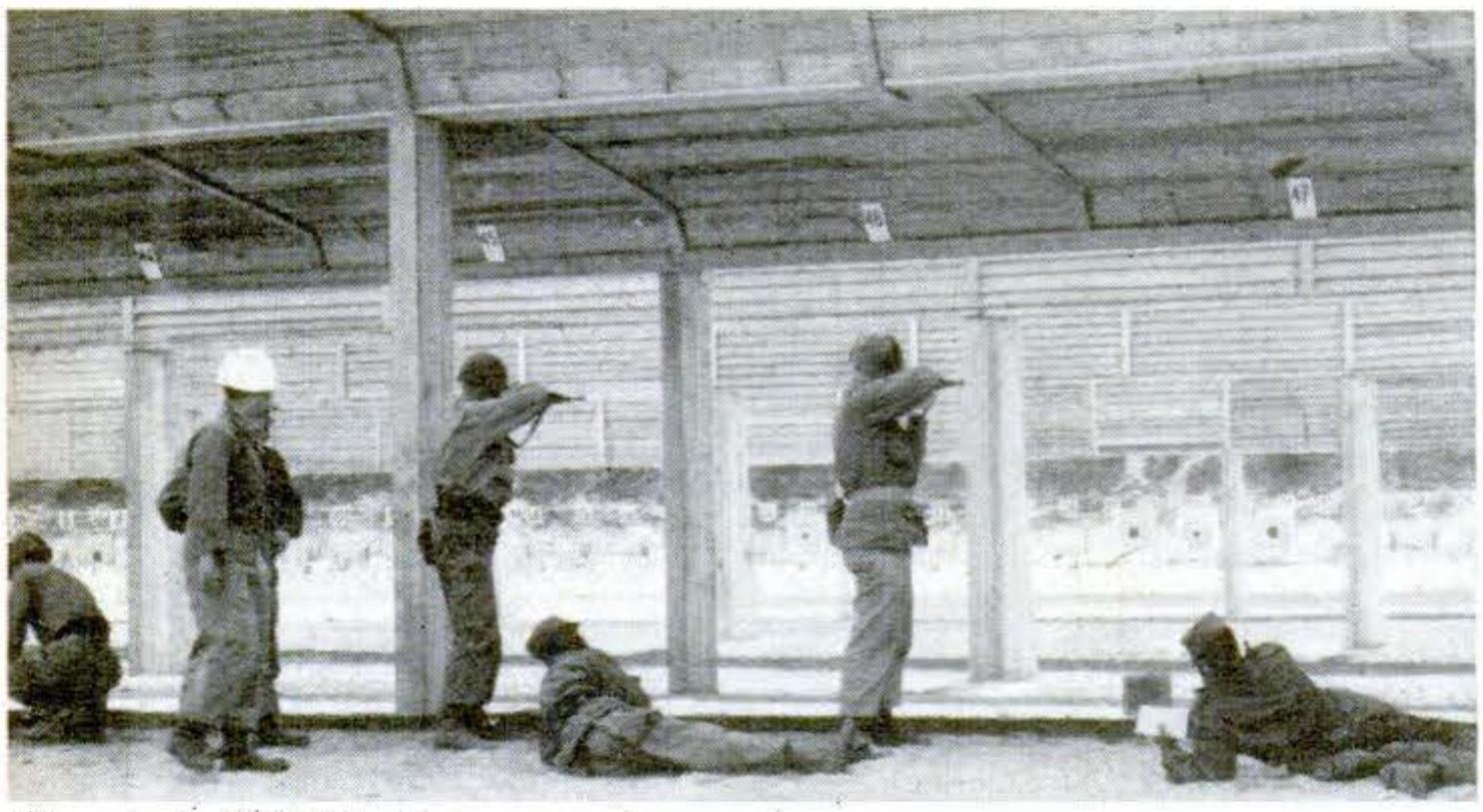
House Stands Under Big Load

FIVE cars and a tractor are parked on the roof of this mobile house to show its strength. Even with middle supports removed, the house sagged less than an eighth of an inch.

A fixture in the roof allows a crane to pick up the house and load it onto a trailer for transportation to a site. Albert Bachand of North Adams, Mass., hopes to market the house.

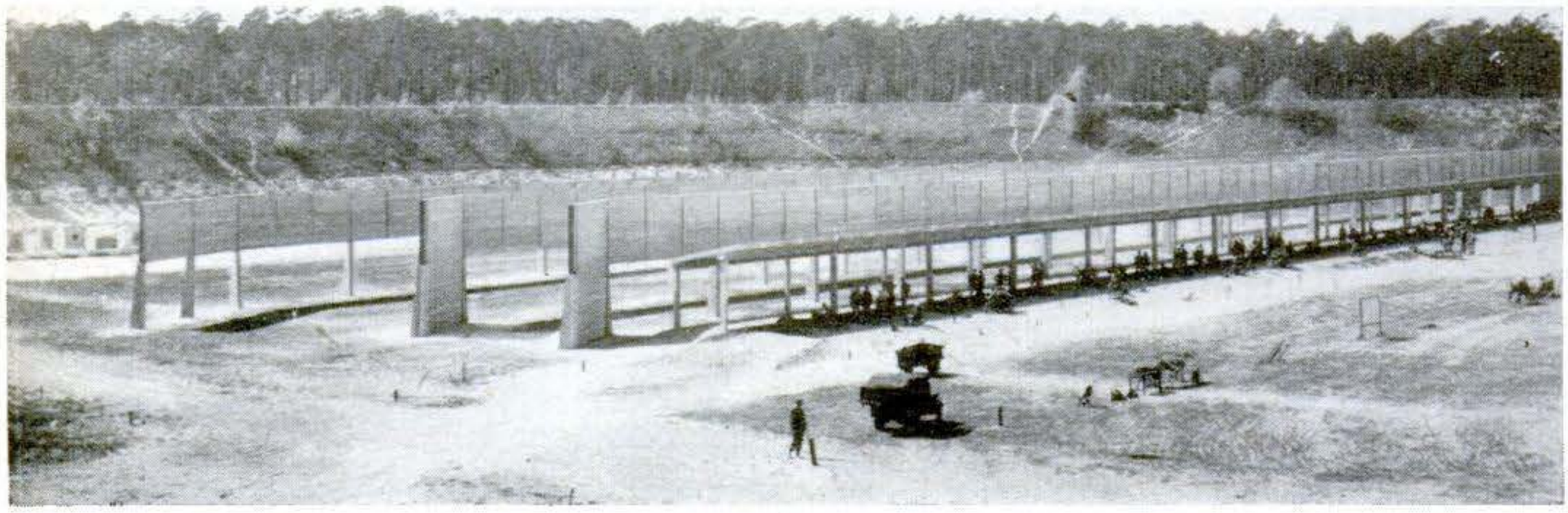
▶▶▶Wanna buy a can of germs? A newly discovered strain of bacteria culture is being sold by the quart, not to spread disease but to help prevent it. Flushed into a septic tank, it thrives on waste, reproducing itself to prevent clogging of the tank. The Fermex Co., Newark, N. J., sells the concentrated culture.

▶▶▶An electronic watch that can run for two years without being wound, whether worn or not, has been developed in France. A battery no bigger than a coffee bean powers a motor just as small, 1.75-millionth horsepower, to put the movement in operation. A watch under test at the French Observatory hasn't varied more than a second a day.



Concrete Baffles Wild Bullets

THIS firing range used for target practice by GIs on duty in Berlin has concrete baffles to protect bathers on a nearby beach. Installed at the 100-, 200- and 300-yard firing lines, the baffles are elevated so that only bullets fired on a safe trajectory can pass under them.



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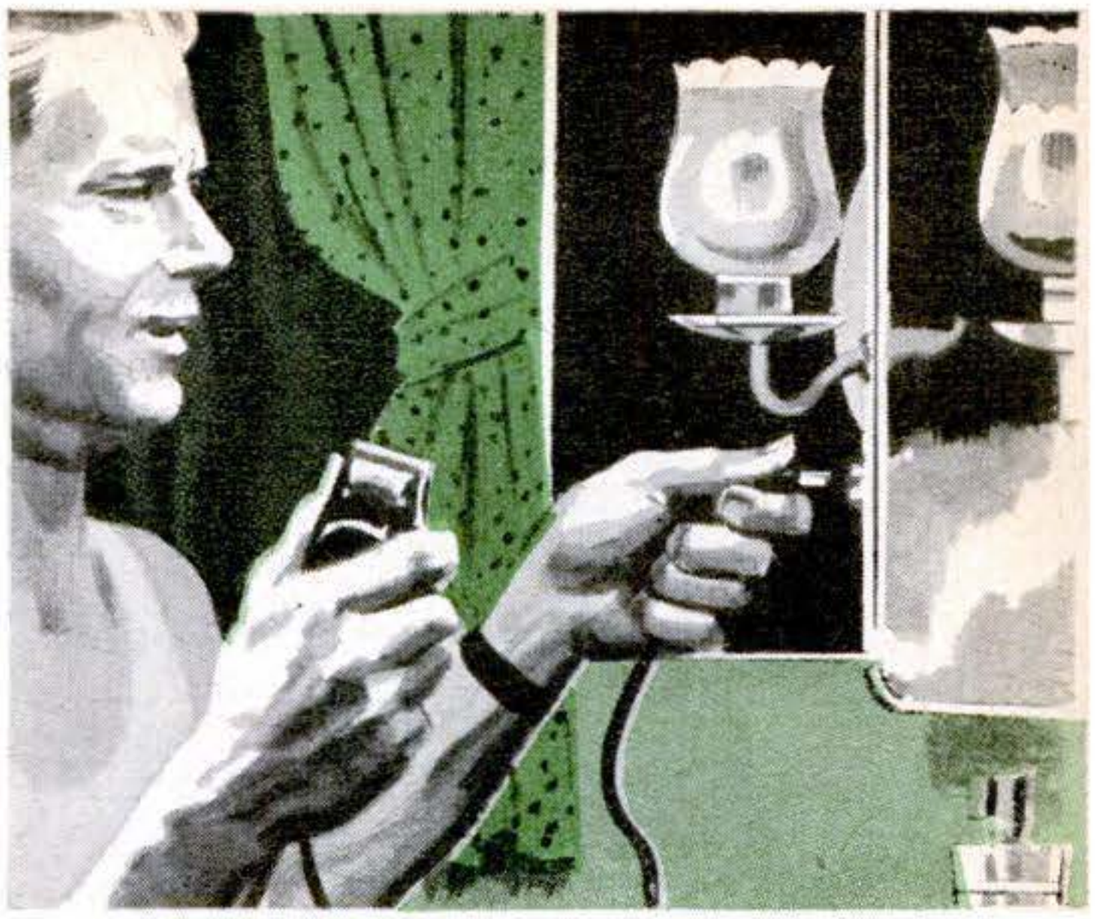
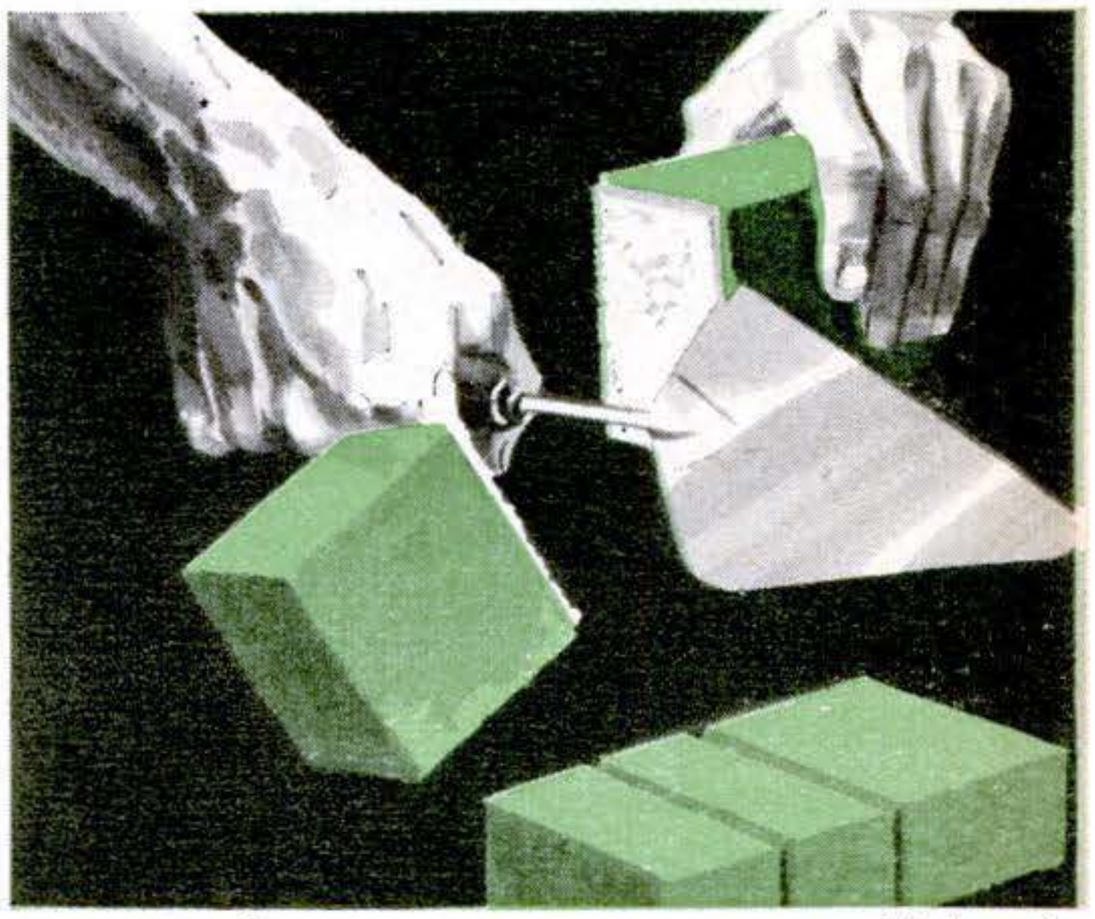
I'd Like to see them make...

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science Monthly* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



A FACE AND SCALP MASSAGER that would fit on an electric razor. It could be made to go over the cutting head or to interchange with it.—*Ronald West, Linnhurst, N. Y.*

COFFEE CUPS that would keep the brew hot to the last drop. They could be made of double-walled plastic, like the thermo-glasses for cold drinks.—*H. Thompson, Chattanooga.*



A BRICK that an amateur mason could break to fit without tearing it to pieces. It could be made for use only where odd sizes are needed.—*D. L. Turner, East Point, Ga.*

ELECTRIC OUTLETS at outdoor stadiums. Then sports fans could bring along an electric blanket and enjoy a football game in comfort. —*Mrs. G. S. Walker, Cincinnati.*

A WHEELBARROW with a removable bottom and an interchangeable screened plate that could be inserted for sifting sand.—*Mrs. Margaret Clark, New Castle, Pa.*

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He Found a Fortune in a School Desk

This home-workshopper started with a project to fit one desk to five growing kids—and ended up with a booming business.

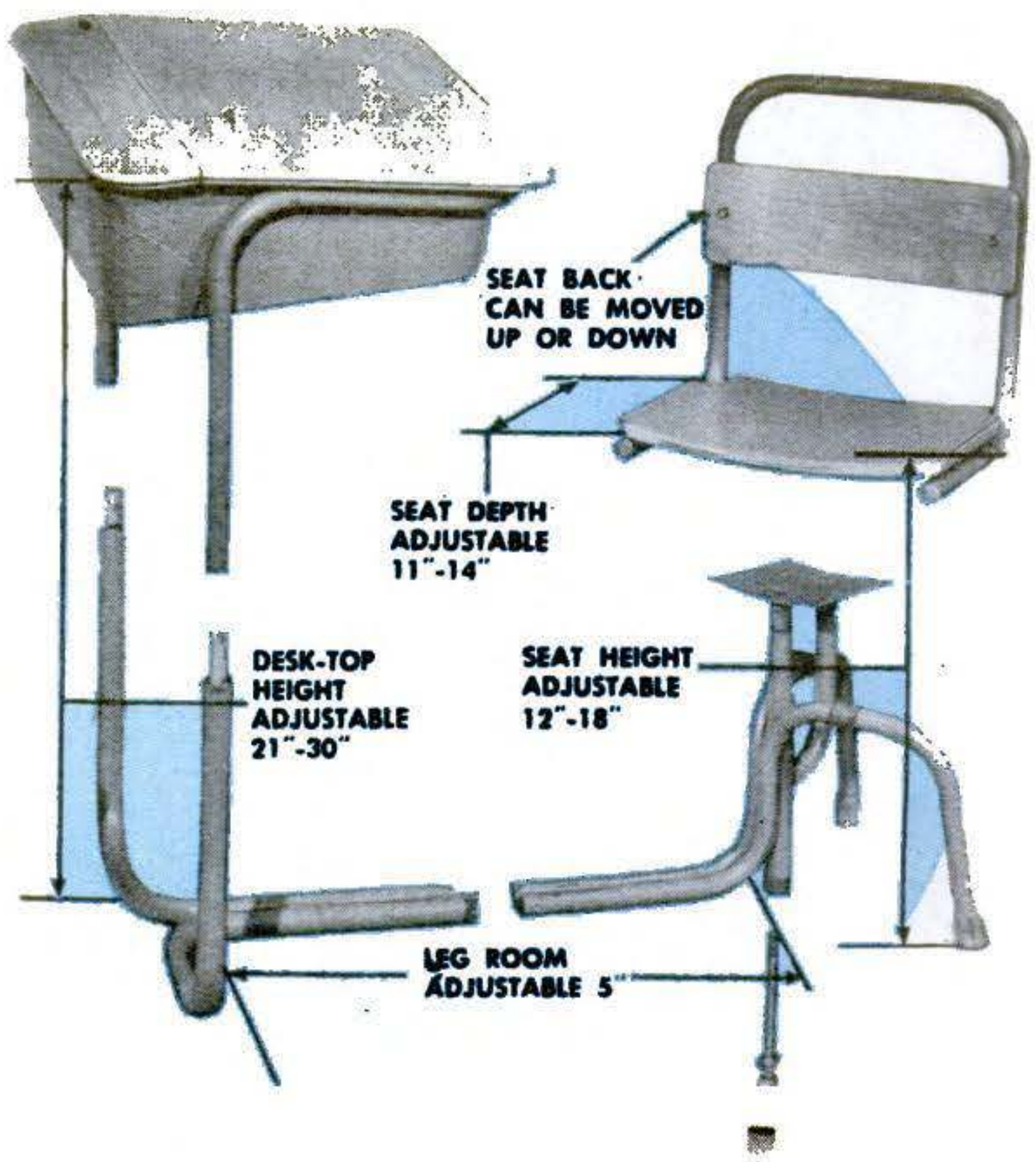
BILL MACWHIRTER has good reason to be thankful that he has five daughters. They caused him, quite by chance, to become a successful inventor.

MacWhirter, who is 37, has for several years been a member of a firm of civil engineers in Grand Rapids, Mich. Mrs. MacWhirter decided about a year ago that their daughters, arranged in height like steppingstones, should do more homework on their school studies. What they needed, she declared, was a single desk that could be adjusted to suit the sizes of all five girls.

Her husband, who has been a constant reader of POPULAR SCIENCE MONTHLY since he was 12 and has tried his hand at many a home-workshop project, rather dubiously set out to fill his wife's order.

His basement workshop contained the usual hand tools. In addition, he had an electric grinder, a welding torch and one of the combination power tools.

He got hold of some one-inch tubing, some rejected panels of straight and curved plywood and some hose clamps. Altogether he spent $10 for materials.



AN EXPLODED VIEW of the commercial model of W. B. MacWhirter's chair-desk shows where it is expandable and to what extent. The cover for the seat-adjustment tube is a grease-cup cap; the legs of the chair have crutch tips. Heights of desk and chair are adjusted by means of screw-threaded rods inside of telescoping tubes.

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He had no drawings to go by, but worked out the design as he went along.

The job took two months of spare time. When it was finished, MacWhirter had a seat-and-desk combination that was adjustable in every dimension. The seat could be raised six inches and its depth increased by three. The leg room could be expanded five inches. The desk top, which could be adjusted to be flat or slanting, was capable of being raised a total of nine inches.

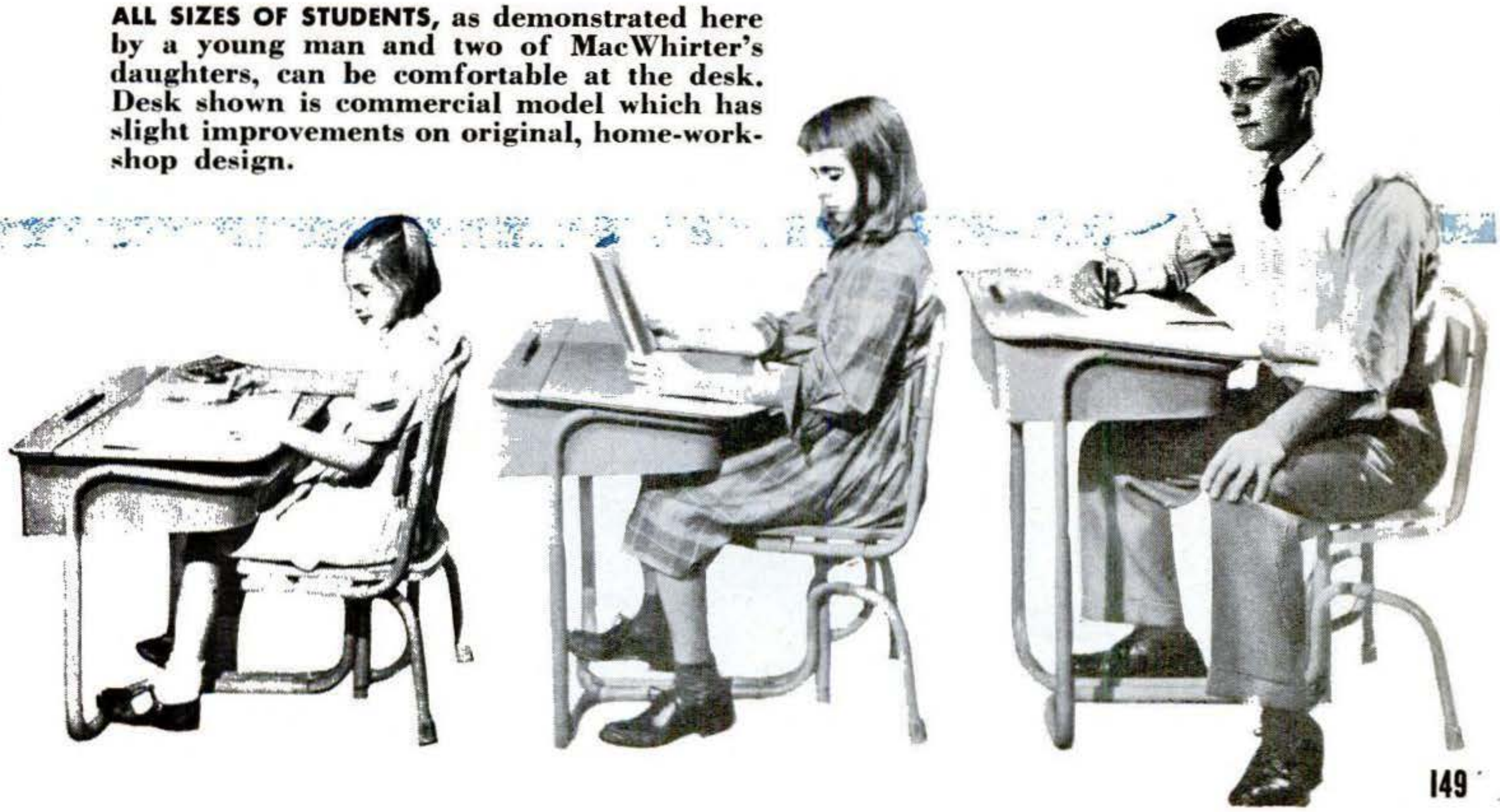
A patent-broker friend saw the commercial possibilities in MacWhirter's desk and helped him patent it.

MacWhirter persuaded a nearby metalworking company and a local woodworking firm to combine forces and build the first commercial models of his expandable desk. They turned out 100 desks in June, 1952. By January, monthly production had risen to 2,800. This past summer MacWhirter began production in his own plant at Grand Rapids, built entirely of secondhand materials, equipped with $15,000 worth of tools and staffed by some 20 efficient employees who can turn out 3,000 a month.

"Why, in Michigan alone," MacWhirter says, with a touch of excitement in his voice, "school authorities figure they'll be needing more than 300,000 additional desks by 1956."—*Wesley S. Griswold.*

THE STORY BEGAN in MacWhirter's basement workshop, where he is shown with his first desk. Having no tube bender, he heated the pipe with a welding torch and bent it by hand.

ALL SIZES OF STUDENTS, as demonstrated here by a young man and two of MacWhirter's daughters, can be comfortable at the desk. Desk shown is commercial model which has slight improvements on original, home-workshop design.



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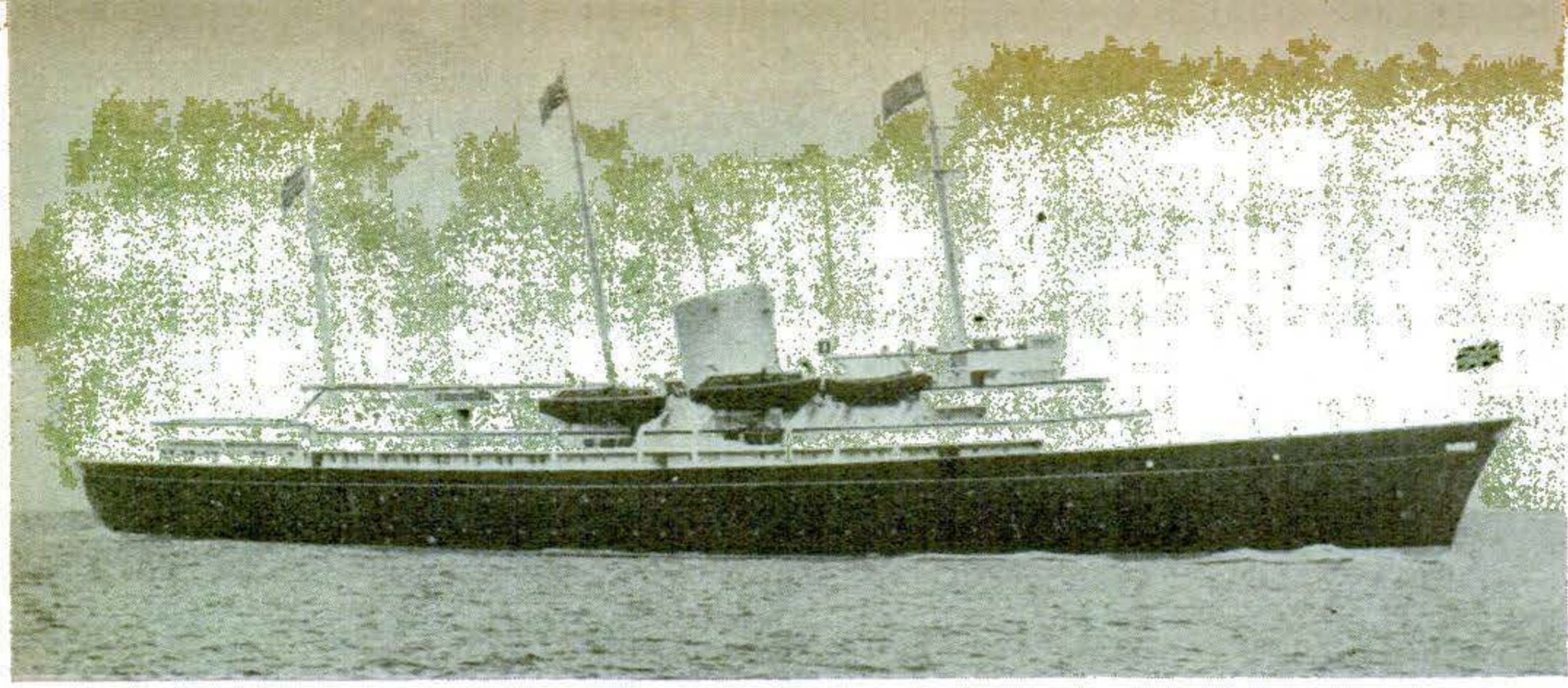


QUEEN ELIZABETH'S PERSONAL VESSEL, shown here as model with sea and sky painted in, will displace about 4,000 tons. It will be 413 feet long and have a beam of 55 feet.

Queen's New Yacht Can Be a Hospital

A DOUBLE-DUTY ship—serving as a royal yacht for Britain's Queen Elizabeth in peacetime and as a hospital ship in wartime—is being constructed in Scotland.

To be christened the *Britannia*, the vessel will have air-conditioned quarters for the royal family and the palace staff. There are electric ranges in the galleys. A laundry will serve both the royal party and the ship's company.

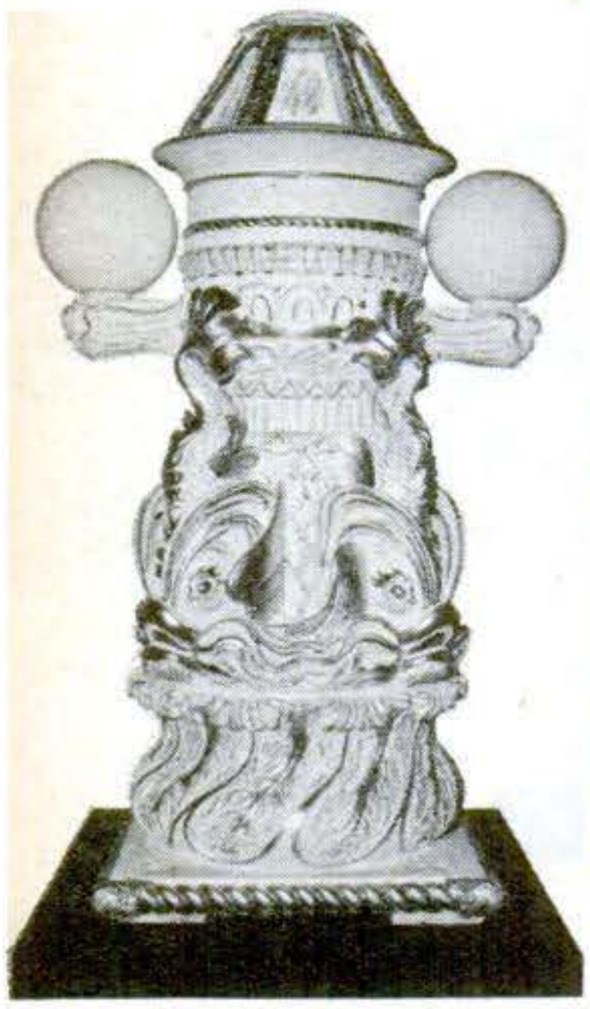
A distilling and water-purification plant will make the ship independent of shore fresh-water supplies.

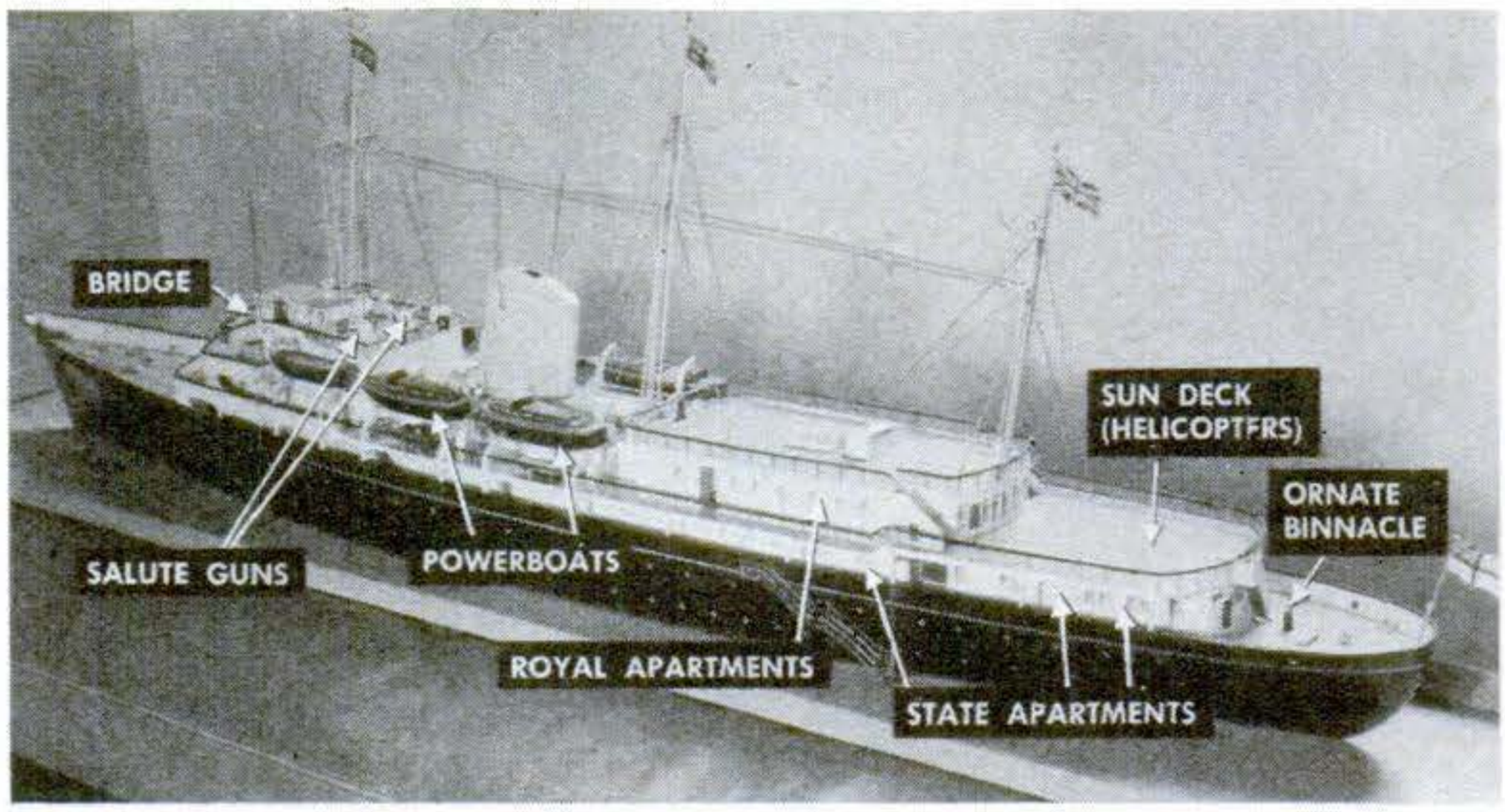
That's the yacht part of it. When and if the vessel becomes a hospital ship, the apartments provided aft of the mainmast for the Queen and her retinue can be converted into wards and operating rooms. The sun deck can become a landing area for helicopters shuttling between the battle lines and the ship.

The principal reason behind this practical arrangement is to offset those critics who may think it an extravagance in the nation's straitened circumstances to spend $5,000,000 for a royal yacht.

The *Britannia* has a modified cruiser stern and a raked bow. A unique funnel design will keep the ship relatively free of smoke. A portable saluting platform will be installed forward of the bridge.

The Queen will have her first ride in her yacht, its hull painted royal blue and gold, next spring.—*William McGaffin.*





AS THIS MINIATURE SHOWS, *Britannia* is trim. Steam turbines will drive twin screws for cruising speed of 21 knots. Crew will be 22 officers, 225 men. Ornate binnacle at left houses afterdeck compass. Once it adorned Queen Victoria's yacht.

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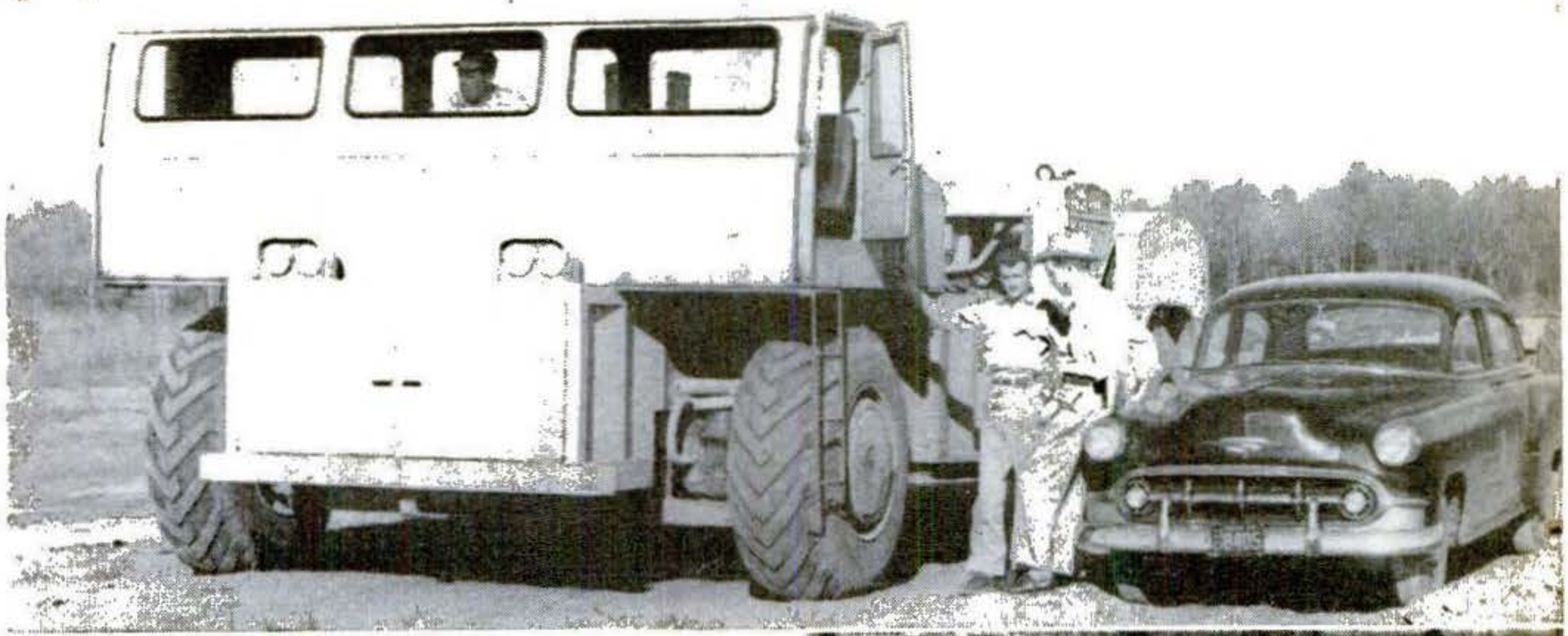
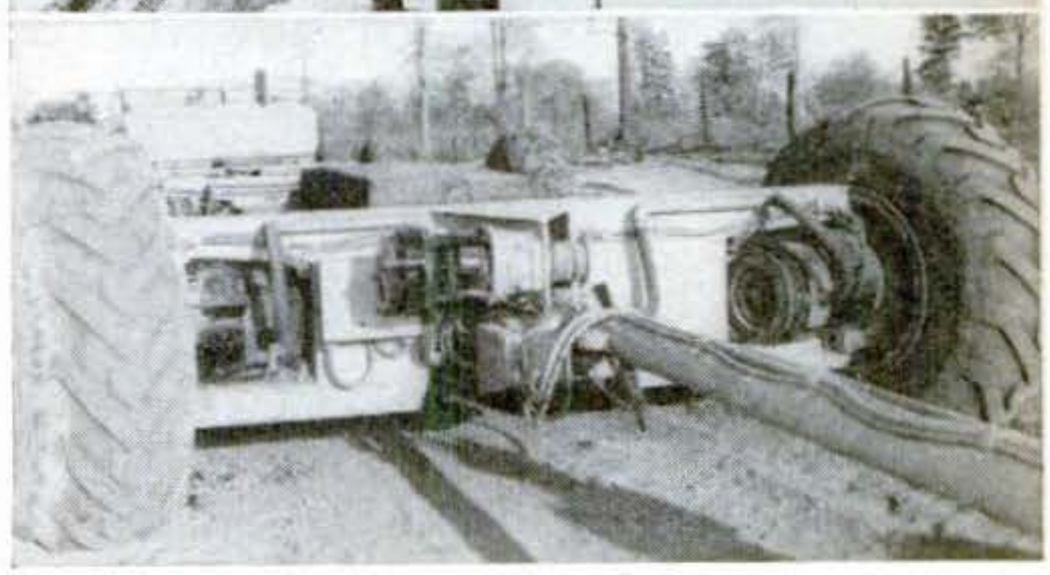
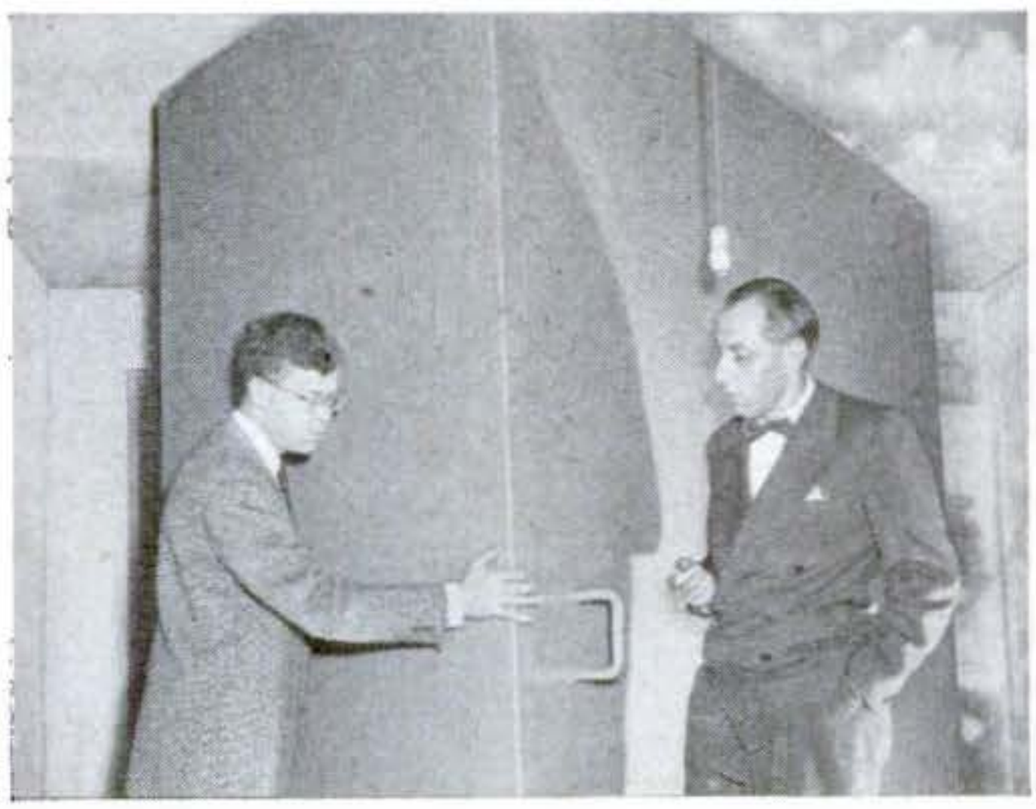


Train Has Cars That Drive Themselves, Need No Tracks

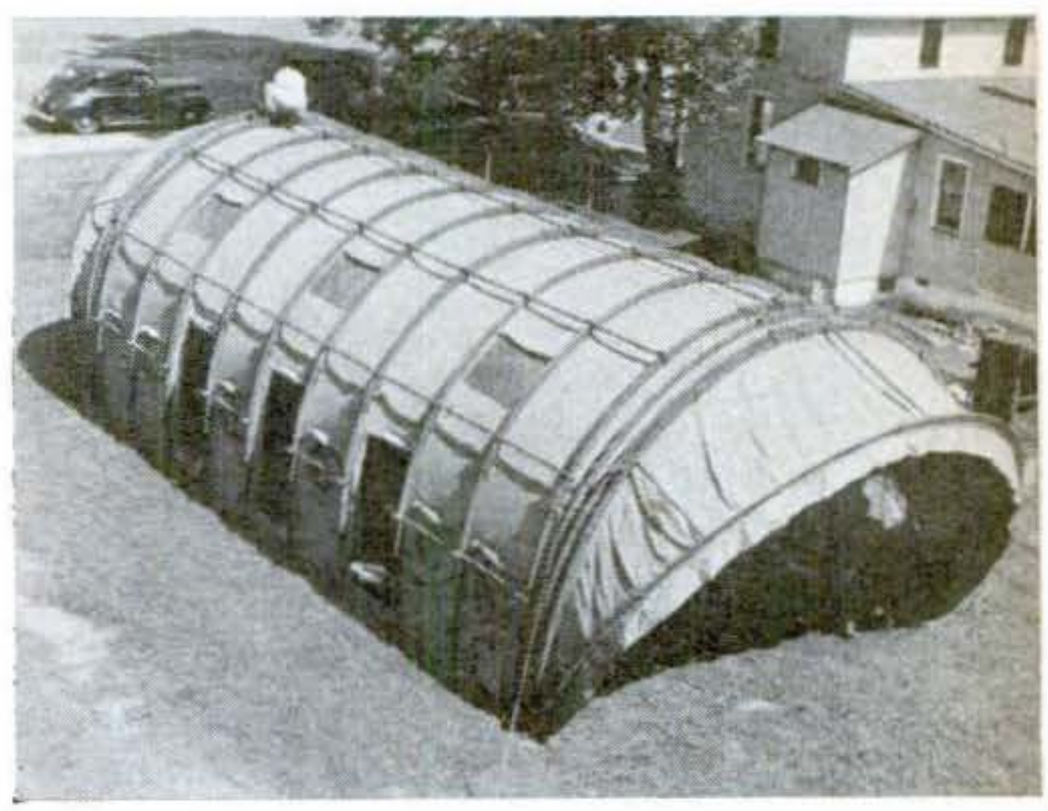


TRACKLESS trains may soon be hauling freight over deserts and through jungles. The LeTourneau "locomotive" (above) and its string of cars (right) travel on rubber-tired, self-propelled wheels that draw power from diesel generators in the locomotive. The engineer feeds power to an electric motor built into each wheel. Cars are coupled to follow in the tracks of the locomotive. When the locomotive turns, every car comes to the same spot and makes the same turn. Wheel motors and steering mechanism can be seen on the stripped car at lower right. LeTourneau says low tire pressures prevent excessive pavement wear.



Don't Slam the Door, Eli

THIS eight-foot door weighs 30 tons—more than two DC-3s—but you can move it by hand. Made of steel and concrete for the underground home of Yale's new 20-million-volt atom smasher, it is four feet thick.



Quonset Hut Is Made of Canvas

THE largest Army tank can be housed in the 1,258 square feet of this canvas shelter. It folds to move with the Army, but when set up withstands an 80-m.p.h. wind. Evans Products Co., Plymouth, Mich., makes it.

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They're Wearing Out

DYNAMITE CAPS in a tire produce a high-speed blowout. Findings: the main perils if she blows at 70 are oversteering and panic braking.

CADDY'S ROLL is measured as it is driven at a constant speed around a circle painted on concrete. Linkage on front wheel reports deflection.

By Frank Rowsome Jr.

IN THE cockeyed calendar of the auto industry, this is New Year's Eve. Soon the great lines will begin pouring glistening '54 jobs into showrooms.

But though '54 models are newer than new, some '54 cars are already tired old crates. Their engines have already demanded a couple of major overhauls. Their bodies have that special limberness that indicates a hard highway life. Speedometers may show 30,000 or 40,000 miles, but if they had an extra digit they'd read 130,000 or 240,000. Still the cars keep pounding along, with three shifts of proving-ground drivers trying to break them down.

Running alongside these prematurely aged babies are some '55 models. With them the frosting on the cake may not have hardened yet—Styling may still brew up new spears or fins, or Engineering may still decide to hold back that fuel-injection rig. But basically these are cars that will glitter in showrooms two and a half years from now.

Testing the '54 Models

When a proving ground wrings out a new model, much naturally depends on whether it is a face lift or a major redesign. But even face lifts are given a hard time, because seemingly minor changes have a way of producing nasty results.

Proving-ground engineers tell a classic tale here. It seems that one year the Nameless Eight was not due to be changed much. However, somebody in Engineering, alert to

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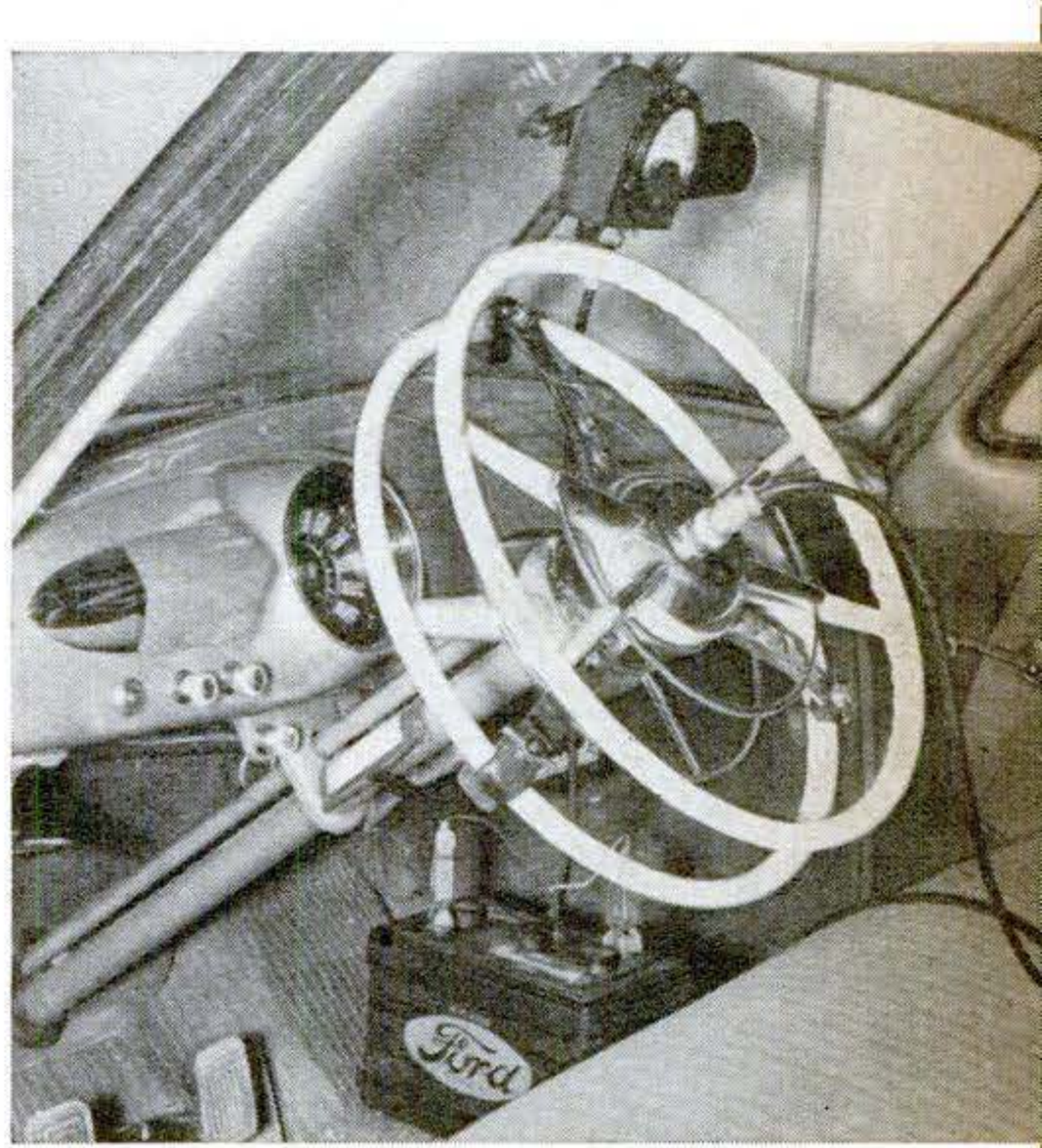
If you think your wife can abuse a car, you ought to see what the proving-ground guys can do. It's the world's biggest bug hunt, but a few will still escape.

'54 Cars Already

knock off a buck, had questioned the need for a cross member way at the back of the frame. Experimental frames without this piece were run off and carefully tested; they seemed fine and were delightfully cheaper. After thousands of test miles the model was released for production.

The public, though, has a knack of testing the testers. It quickly became evident that no one at the proving grounds had thought to bop the car smartly in the rear bumper, fetching it a blow such as might be experienced in clumsy parking or a mild bump in traffic. When this happened both rear doors of the car popped open wide, like a double jack-in-the-box. This embarrassing trait, the story goes, brought both a prompt calling-in of the model for modification and a good deal of head-hanging among the testers.

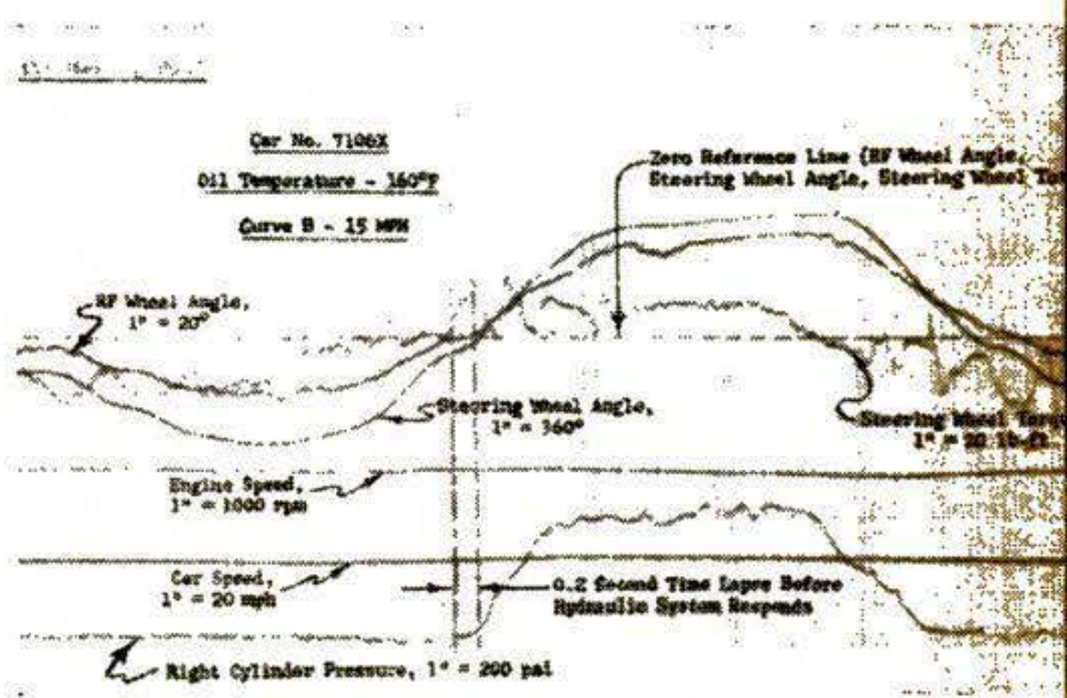


STEERING EFFORT can be precisely reported on this rig. It uses strain gauges to generate an electrical signal in proportion to wheel torque.

Running the Wheels Off a Car

In factory proving grounds, endurance runs are a big part of the program. A batch of four-door sedans is plucked from the production line, and joined with another batch of competitive cars, bought from dealers. Each car is checked to be sure it meets specs and is tuned right. Then the entire fleet is driven hard over assorted proving-ground roads for 25,000 to 60,000 miles.

Speeds and routes are strictly prescribed, and recording speedometers make sure that test drivers follow the book. In every hour there'll be so many miles of fast running, so many miles of hard pulling, so many miles of potholes and cobblestones—all interspersed



PACKED WITH DATA is this oscillograph record of a power-steering test. Six different factors are simultaneously plotted along an accurate time base.

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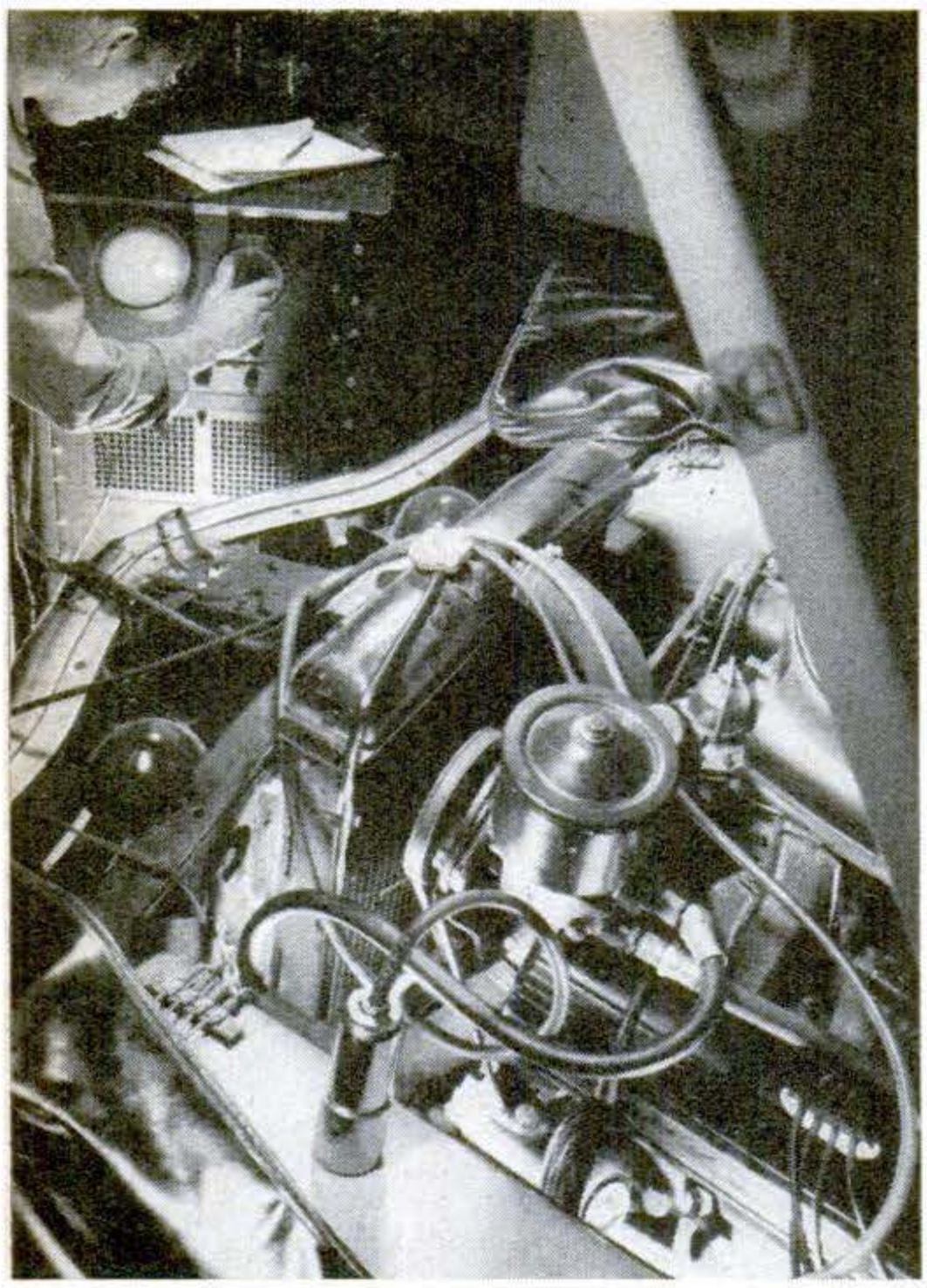

WHISTLE METER is a tricky gadget to find out an engine's exact compression ratio. You unscrew a spark plug, insert a whistle fitting and let the machine blow. As when someone blows over pop bottle, pitch of sound is proportional to volume inside. Microphone and cathode-ray tube translate pitch into ratio.

with zero-to-80-m.p.h. accelerations separated by hard brake stops.

The goal is typical but accelerated wear. One durability-run mile may equal 1½ to three consumer miles, depending on how rough an owner and his roads are. Two or three sets of tires are often chewed up by each car on the run, which usually goes on uninterruptedly through three shifts. The change of drivers helps wash out any effect of driver peculiarities.

The only time a car is stopped is for periodic engineering tests to check, for example, on deterioration of brakes, acceleration or cooling. If a car conks out, or if it gulps oil or loads up with carbon, it is put in shape and sent out again to finish its miles—with extra charges assessed against it.

When the run is done each car is torn down and its parts spread out on a long table. Company engineers are called in to view the remains. Transmission men see how their boxes did against the competition's; suspension men measure kingpin wear; engine people mull over worn bores or pitted valves.

In after-hours talk at proving grounds, the stories sometimes fly about the years when the vintage was poor.

There was the car with the carburetor nobody ever could adjust, and the one that burned its plugs with gay abandon. There was the car with the growling power steering, and the one that liked to bend its tie rod. There were ones with a built-in gasoline smell, or a whining rear end, or an insatiable oil thirst.

There have also been a few celebrated weirdies like the sedan with the pop-open doors. On one you had to partially remove the engine to replace the fan belt. On another it was discovered with horror that you had to unbolt a back fender before you could change a rear tire.

How Do the Bloopers Get By?

Proving-ground engineers hasten to explain that these classic bobbles are the exception, and are much less common than a decade ago. They also have these explanations why an occasional dilly still gets out:

1. Sometimes, quite infrequently, it is a human error in testing. Time pressure and the pre-announcement rush can lead to fumbles.

2. Occasionally test engineers may report a flaw but fail to make themselves heard in the upper reaches of authority. They console themselves with the thought that it may have been a "big picture" decision. Somebody living in a box way up the organizational chart may have judicially weighed the annoyance of, say, a windshield reflection against the tooling cost and time required to correct it.

3. Most often, a blooper springs from some minor difference between the partly handmade car tested and the production-line car sold. Sometimes it is a small variation in material or fabrication. It can be a quality-control headache on the

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line. It may mean that Engineering has brewed up a blueprint that lays unreasonable demands on Manufacturing.

In any case the blooper calls for quick work. Engineers stay up nights doping out an immediate change in production and a fix procedure to go out from the Service Department. These too must be intensively tested; a fix that didn't would be grim indeed.

Wringing Out '55 and '56 Models

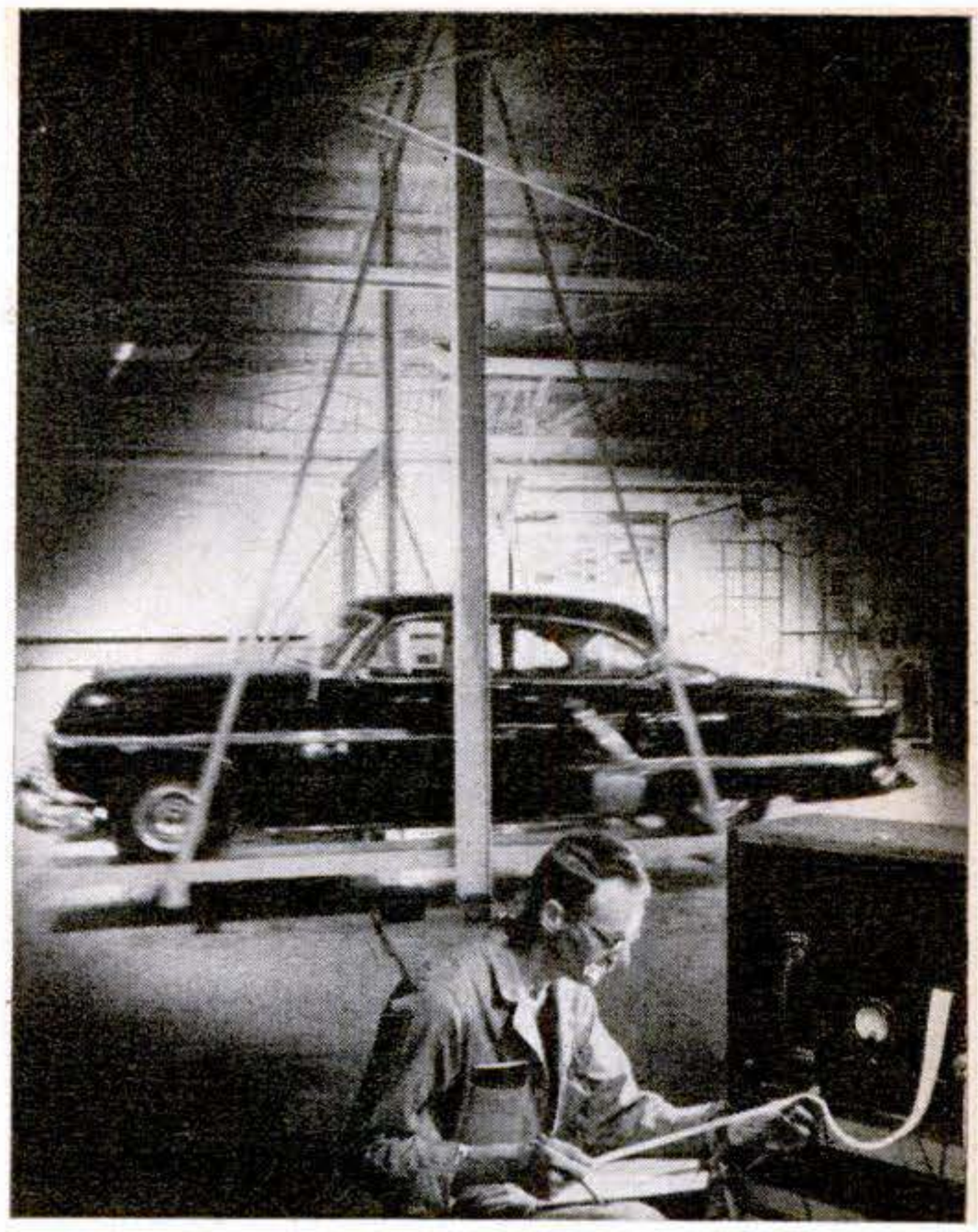
In advance testing the pressure is a bit lighter. Major engineering changes are not decreed, developed and tried out in months but in years. Pontiac's and Chevrolet's unreleased V-8 engines, for instance, have already been in test for a couple of years apiece. Plymouth's engine specialists are currently working hard on a new block that the salesrooms may not see before 1956.

Much early development is done first in engineering labs. When an experimental engine or gearbox does come out to the track, it is usually installed in a current car, as a matter of "security" as well as convenience.

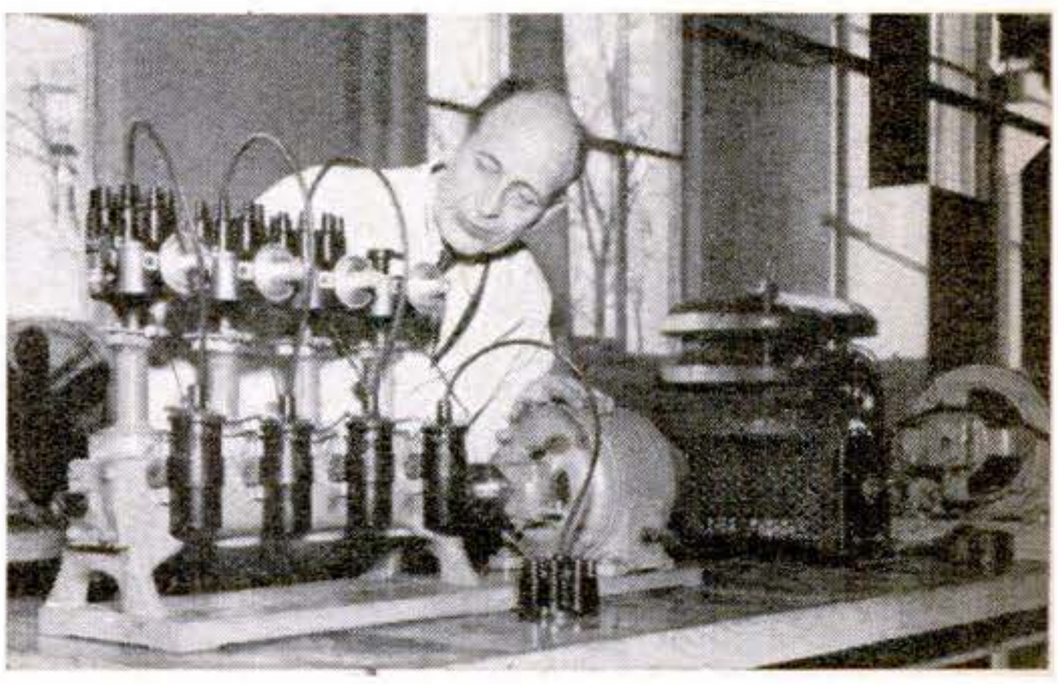
In most proving grounds new cars, both a company's own and its "critical competition," are meticulously measured and then taken entirely apart for study. Each piece is weighed and photographed. A radiator designer, for instance, might discover that the competition is running a core that is 13 ounces lighter than his own. This can mean plenty of pennies, and in mass production pennies can mean thousands of dollars.

The measurement part of this analysis also gives a line on the nicety of the production plant. Cars turn out to be less uniform than you might think. Departures from the blueprints of two inches or more may be found on soft trim parts, and even wheelbases can vary by four-tenths of an inch. Compression ratios can depart from specs by three-tenths of a ratio, and differ from cylinder to cylinder. Sometimes this is careless inspection; more often it is a toler-

[Continued on page 249]



GIANT SWING isn't just to give Olds some kicks—it locates center of gravity. By timing car's pendulum period on two different swings, engineers can find the CG.



FLIP A SWITCH and you can subject these Packard distributors to thousands of miles of wear. The high-voltage coils make it an electrical as well as a mechanical test.

CHURNING HARD with its Ultramatic drive in low, this Packard wallows through a deep sand pit. "Cat" is kept nearby to snake out the cars that dig holes for their rear wheels.

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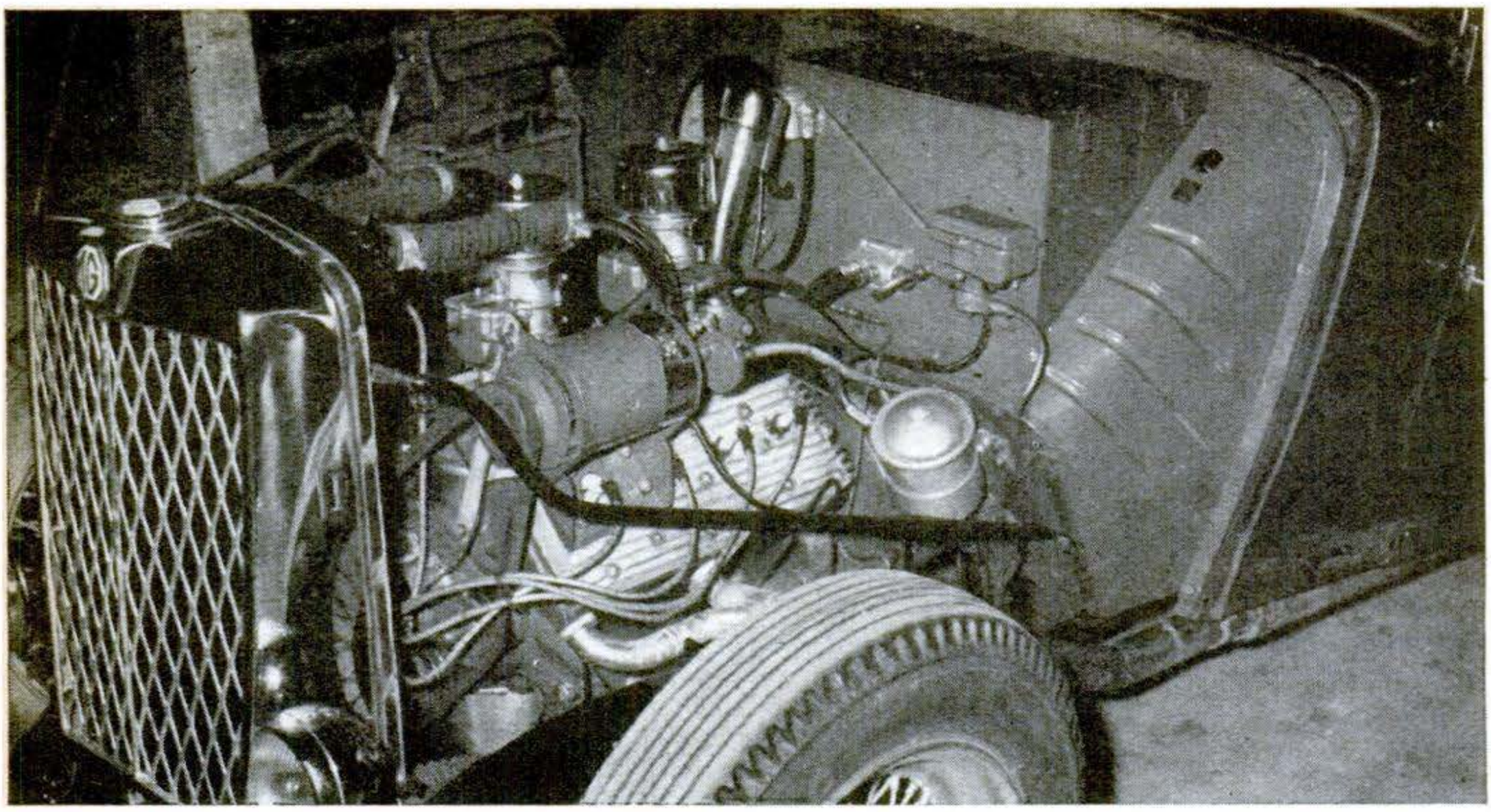
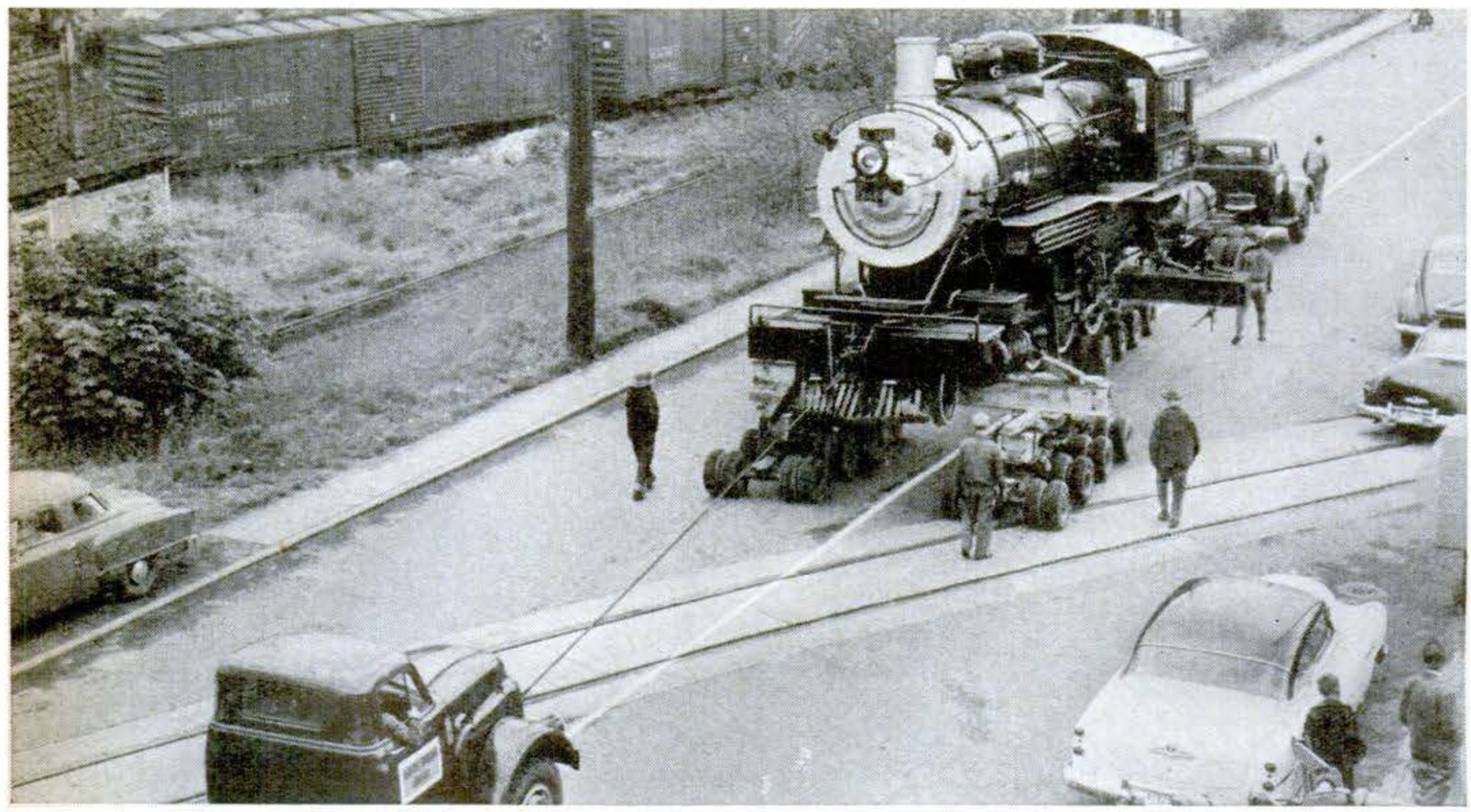


Souped-Up MG Goes "Jag Hunting" with a Ford V-8 Engine

THANKS to its 1940 Ford V-8 "60" engine, the MG above hits well above 100. The engine turns over 7,000 r.p.m. The original TC four-speed gearbox has been kept, the clutch is the Auburn type. With a special four-inch radiator core in the original MG radiator shell, the engine runs cool without a fan. The block is bored to 2.714 inches, the stock stroke retained. Aluminum-alloy, three-ring racing pistons are used, with a full race cam. Nine-to-one compression heads and dual 81 Stromberg carburetors were used in the job by Ken Dunn, Ford Motorsports Club, Dearborn, Mich.



Old Iron Horse Takes Its Last Canter on Way to Pasture

EYES popped in Seattle when Old 1246 came rolling down the asphalt. Last steamer on the Great Northern's Cascade Division, the 46-year-old locomotive was highballing to her final home in a park nearly three miles from the nearest rails. Six house dollies carried the 211,000-pound iron horse on 48 rubber tires. A heavy-duty truck did the hauling; another braked behind on downgrades, went ahead to help up hills.

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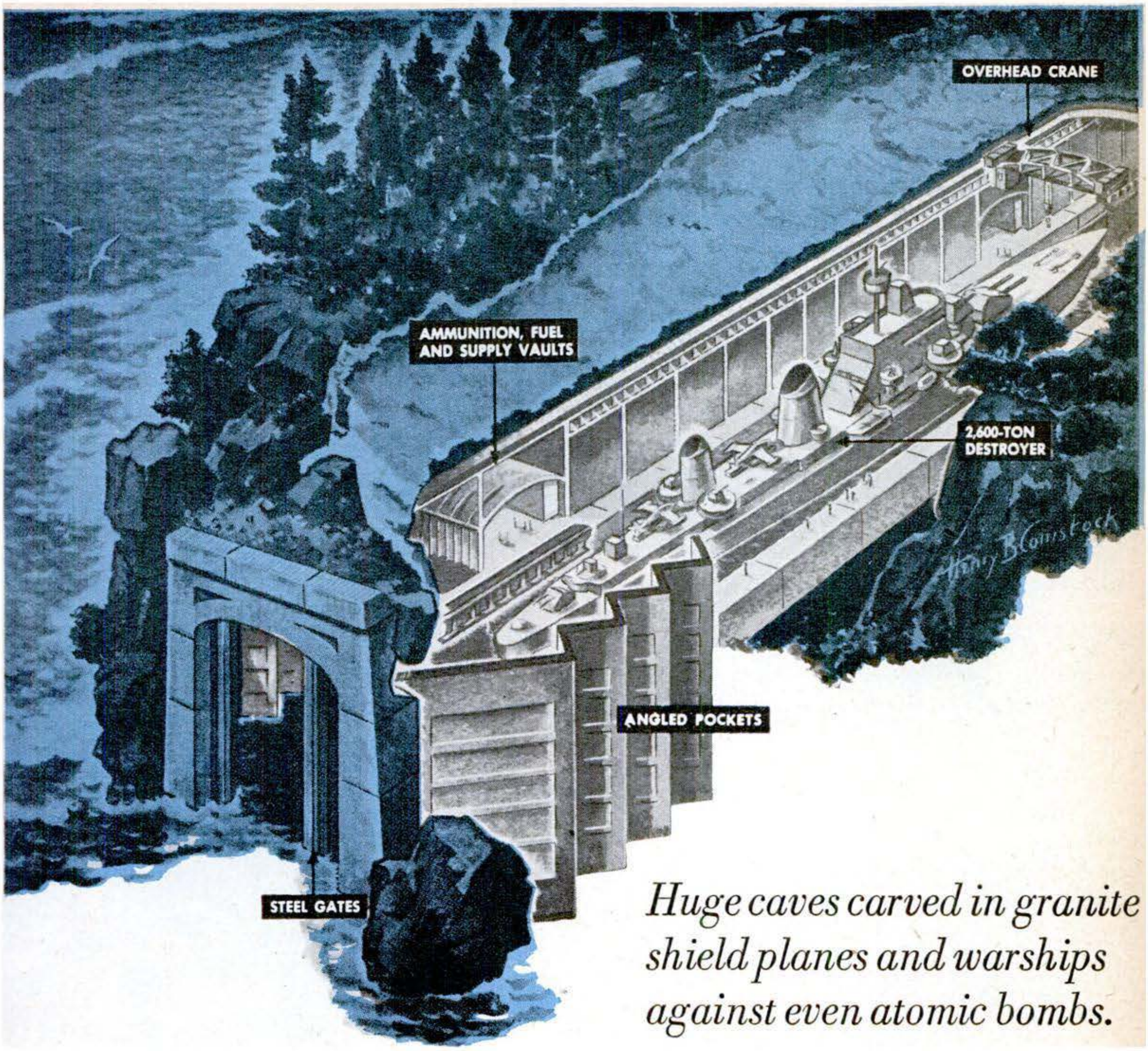

Huge caves carved in granite shield planes and warships against even atomic bombs.

Swedes Hide Punch Under Mountains

HER blue and gold ensign fluttering, the big destroyer heads straight for shore. Ahead looms a rocky cliff where one of the hundreds of islands that fringe the Swedish coast drops into the sea. But suddenly a huge hidden door swings open.

In a moment the ship has vanished into the mountainside. The gates swing shut. The sea is empty.

This disappearing act is Sweden's answer to a grim bit of military geography. From the nearest Russian island to Stockholm is just 145 miles as a bomber flies. The Swedes are determined never to have a Pearl Harbor.

Inside the mountain, the destroyer berths in a tunnel 96 feet high and 57 feet wide, blasted out of solid granite. The entrance is protected by heavy gates;

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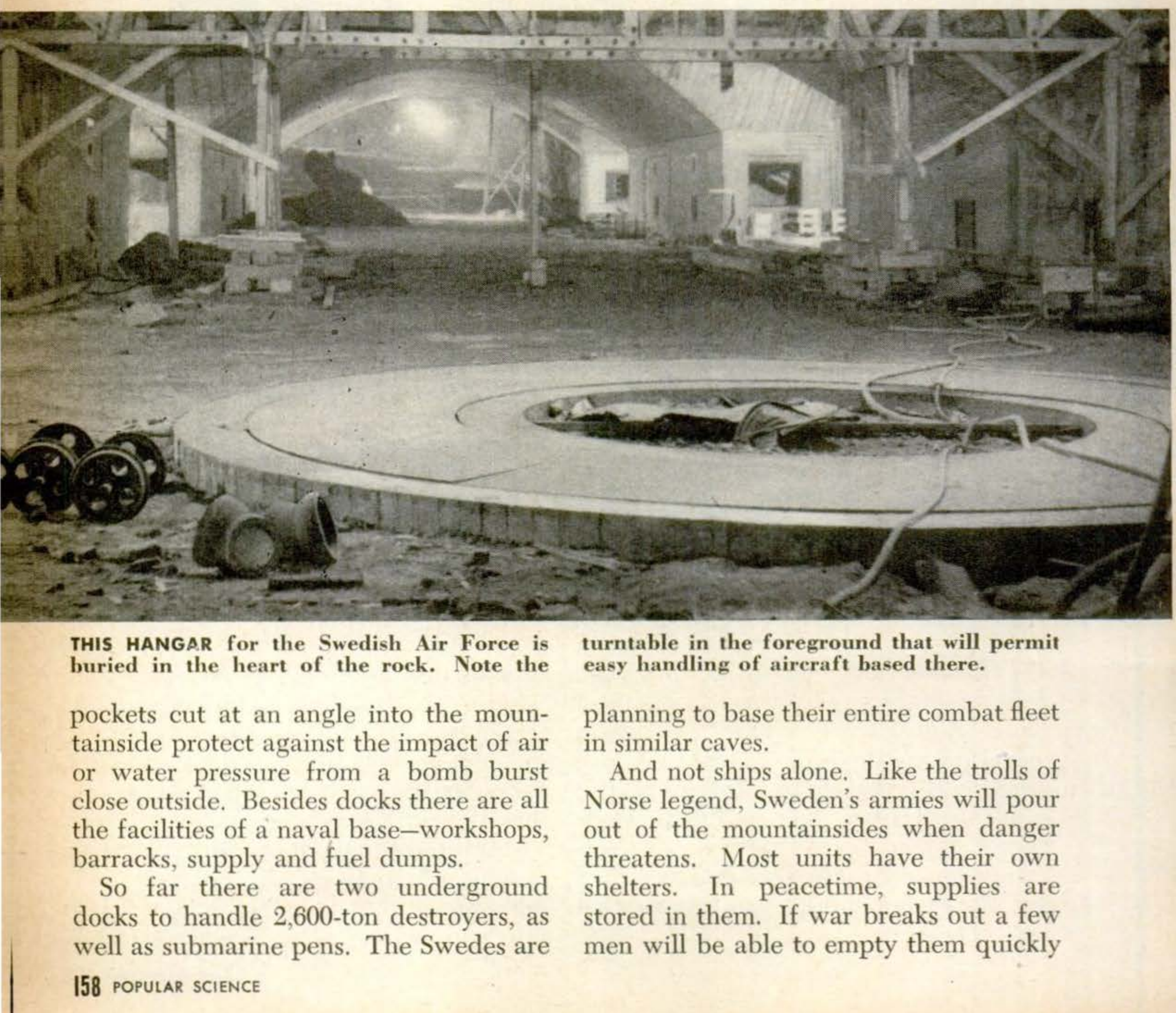
CUT OUT OF SOLID ROCK, tunnels like the one above connect storehouses, docks, barracks, forts, hangars—all hidden underground.

CEMENT IS SPRAYED onto steel-reinforcement mesh laid over the rough rock ceiling of a tunnel. Method is borrowed from U. S.



THIS HANGAR for the Swedish Air Force is buried in the heart of the rock. Note the turntable in the foreground that will permit easy handling of aircraft based there.

pockets cut at an angle into the mountainside protect against the impact of air or water pressure from a bomb burst close outside. Besides docks there are all the facilities of a naval base—workshops, barracks, supply and fuel dumps.

So far there are two underground docks to handle 2,600-ton destroyers, as well as submarine pens. The Swedes are planning to base their entire combat fleet in similar caves.

And not ships alone. Like the trolls of Norse legend, Sweden's armies will pour out of the mountainsides when danger threatens. Most units have their own shelters. In peacetime, supplies are stored in them. If war breaks out a few men will be able to empty them quickly

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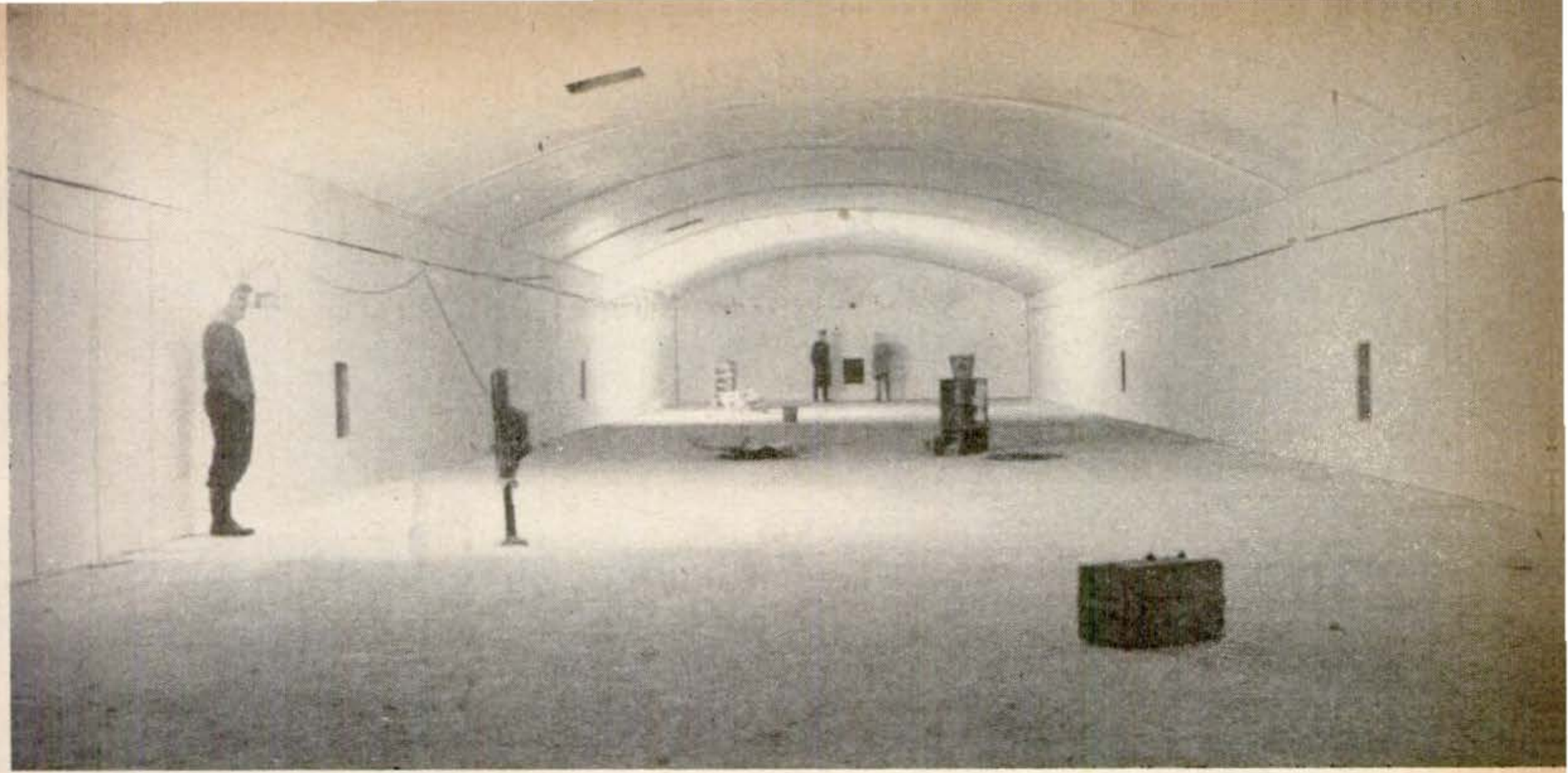
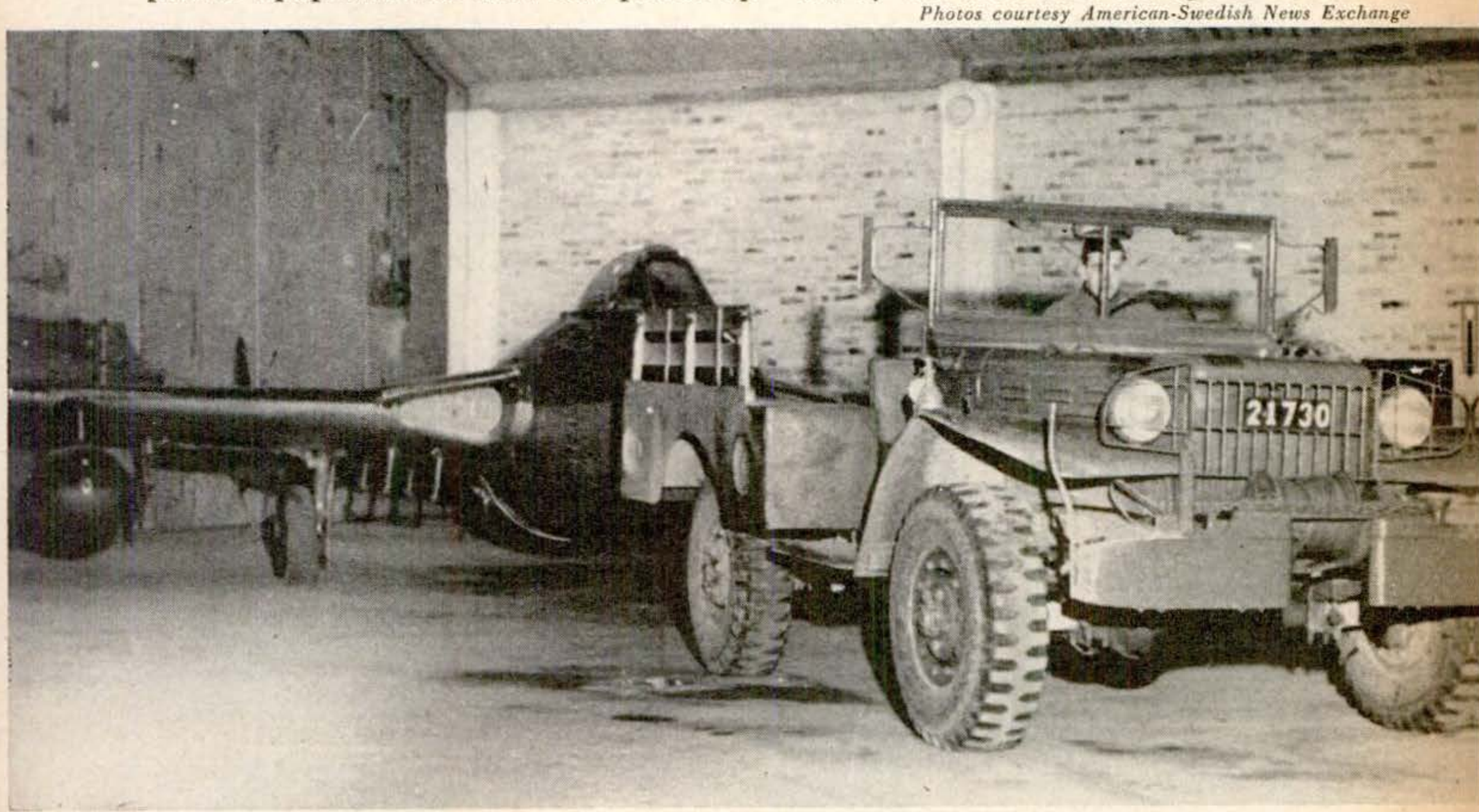


FINISHED, underground storeroom is completely sealed with concrete. Thanks to improved equipment and know-how picked up as they go along, Swedes say, they have increased efficiency of their construction methods by one-third since the operation started.

Photos courtesy American-Swedish News Exchange



TRUCK HAULS a Swedish Vampire fighter to a runway from one of the completed underground aircraft hangars. More hangars are being built under the rock in big program.

on roller conveyors; workshops and other installations will move in.

Even the Swedish Air Force is based underground—planes, fuel, ammunition, men. So are radar and fire-control centers, coast artillery batteries. Oil and gasoline are stored in abandoned mines, filled by pipelines to tanker docks.

Each administrative district has its own underground civil-defense center. In one place, a 1,000-room "city" has been blasted out of a mountain, equipped so that people could live there for several years. Altogether there will be some 500 military shelters. Blasting them out of granite is costing $86,000,000.

The Swedes don't want trouble. But if it comes, they aim to be ready. END

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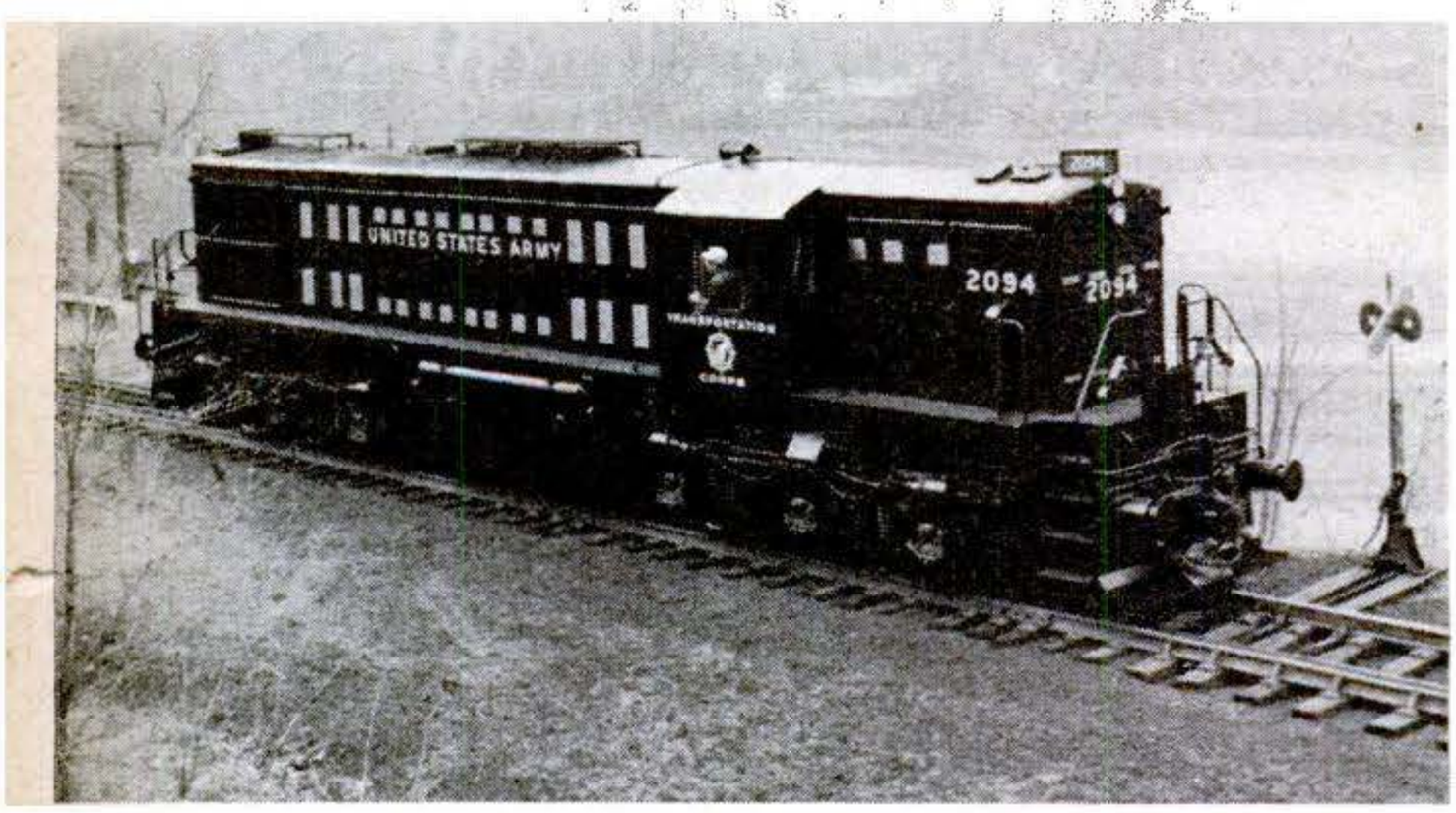
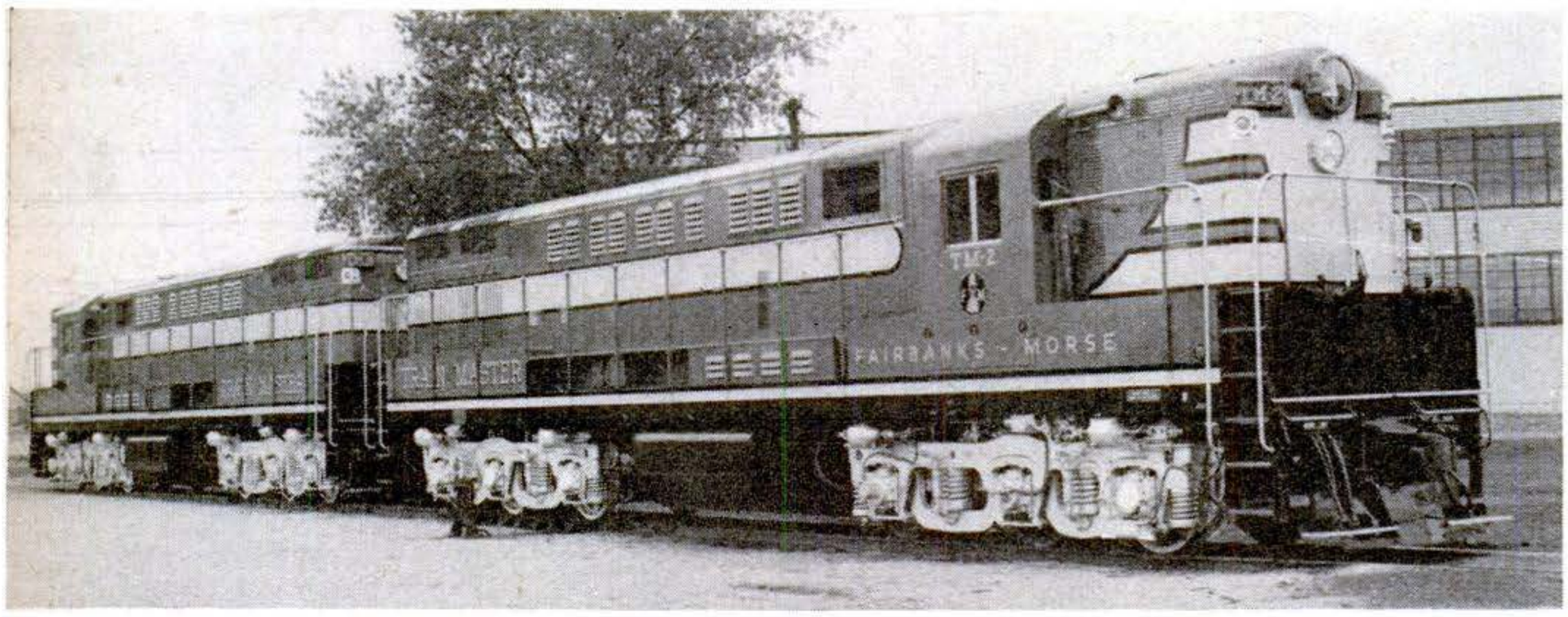
Coach Sleeper Fits 40 Travelers into Standard 85-Foot Car

TUCK in enough bunks and you have a sleeping car in which you might sell space at close to coach rates. Around this idea, Budd engineers planned the Siesta Coach above, now in mock-up stage. A standard one-vestibule 85-foot passenger car, its space-conserving layout provides room-type accommodations with cot-size beds and



GI Locomotive Rides Any Width Track

WHEREVER the Army might go, this military locomotive is ready to move it—in any climate and on any track in the world. Low, narrow and light to meet foreign load limitations and road clearances, it has two trucks with long axles on which the wheels can be set for any gauge. An Alco-GE diesel-electric road switcher, it can do its work at 65° below zero or 125° above.



Big Fellow Tackles Heavy Jobs

THE world's most powerful single-engine diesel is what Fairbanks, Morse call their Train Master. Two of them are shown in tandem above. Together, they put out 4,800 hp. and do the work of a conventional three-unit combine made up of 1,600-hp. diesels. A universal locomotive, it handles all heavy jobs, passenger or freight.

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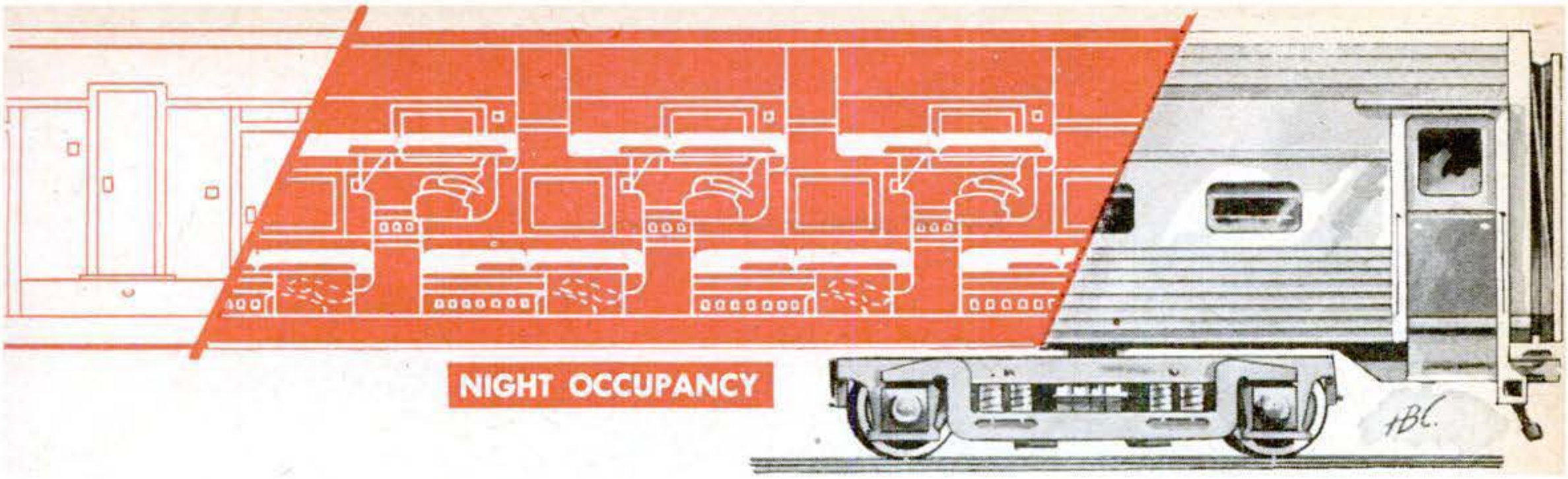
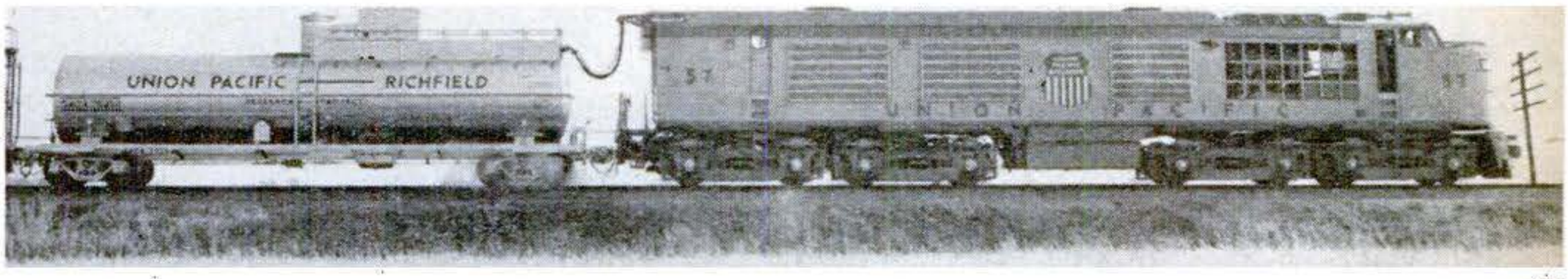


private lavatories for 40 travelers—as against 20 to 30 in a Pullman. A double room and 18 singles are strung along each side of a center aisle with alternate singles two steps up.

To wean the family trade from plane travel, cribs with foam-rubber mattresses are planned for each car. The crib will be visible from the mother's bed in a mirror on the door. The low fare—coach ticket plus service charge—might also lure bus travelers back to the rails.

Walkie-Talkie Speeds Mud Hop's Work

THIS "mud hop," or car checker, is calling off the car numbers of an incoming freight to a clerk miles away. He's using what's claimed to be the smallest and lightest walkie-talkie ever made, a Motorola FM set. It has a five-mile range and runs on 40-hour dry-cell batteries. Use of walkie-talkies in freight yards has sharply reduced the time required to switch cars.



Tank Car Feeds Gas Loco

THE old water tender that trailed behind steam locomotives is back in a new guise. A tank car full of liquid gas, it feeds a new breed of iron horse—a gas-operated turbine-electric locomotive. Gulping propane, the 4,800-hp. locomotive can haul 79 loaded cars weighing 4,650 tons up steep grades, say Union Pacific engineers.

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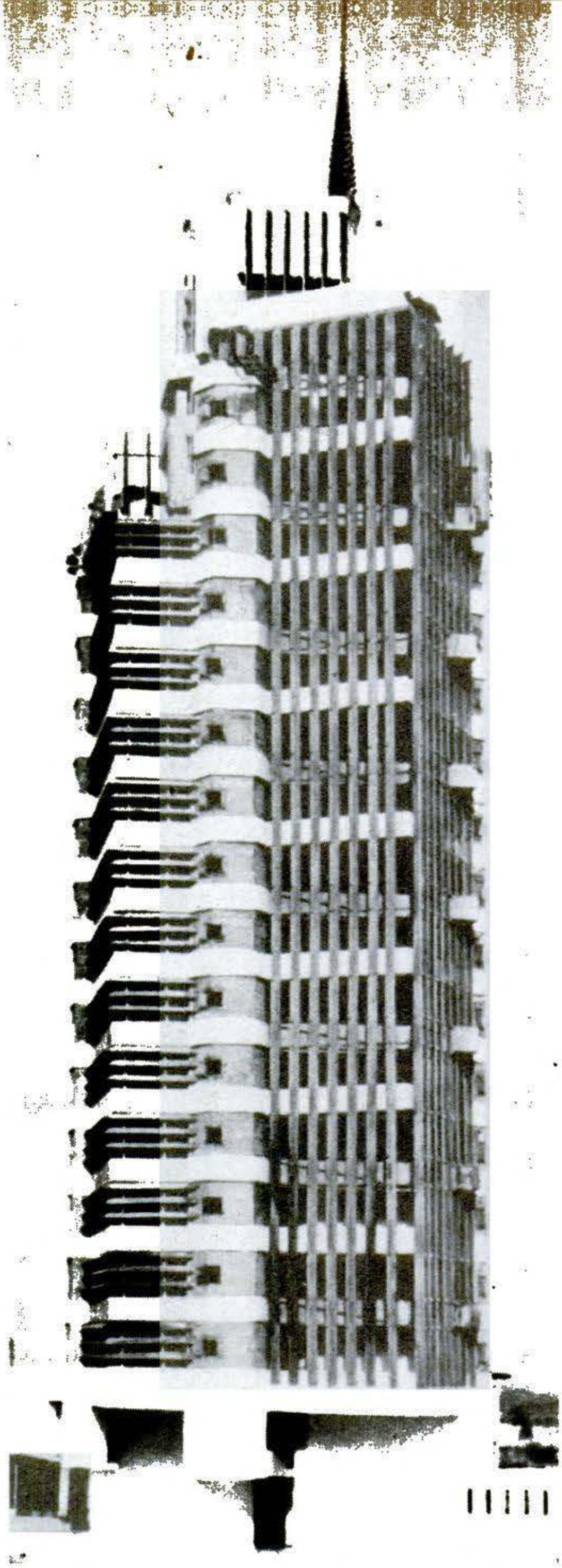
Prefab Steeple Takes a Ride

THE steeple above, riding high on an 80-foot boom and jib, was prefabricated to save the carpenters a lot of work high in the air. Once lowered into position on the belfry, the crane held it secure while the carpenters simply bolted it in place. *American Builder* photographed the job at an Arlington Heights, Ill., church.



Prairie Tower Hangs from Fins

TOWERING over 800 square miles of Oklahoma, this 18-story Bartlesville skyscraper will be a "segmented quadruped," says architect Frank Lloyd Wright. Floors will hang from a cross of concrete fins, with offices in three quadrants, apartments in fourth. From some angles, Price Tower will appear copper; from others golden glass.

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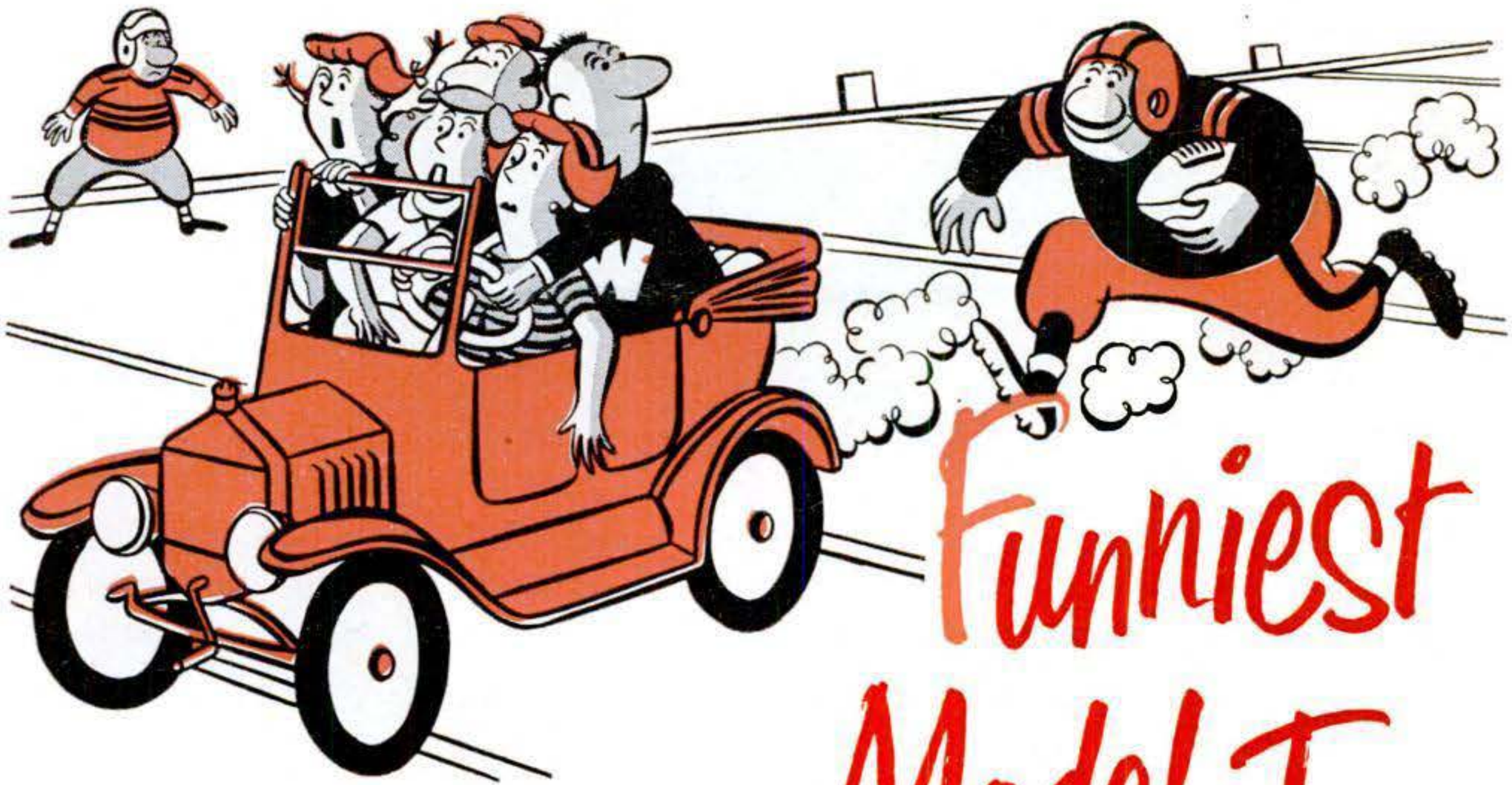

Funniest Model T Stories

Here are some Popular Science readers' favorite yarns about the most famous automobile ever built. They bring back the good old days of motoring.

Last June, POPULAR SCIENCE MONTHLY *announced that a reconditioned Model T Ford would be presented to the reader who submitted the funniest story about his experiences with a Model T. The contest closed August 1. Here are some of the many good stories that were submitted. The prize-winning story, chosen by a distinguished panel of judges of good cars and good stories, will be published in* POPULAR SCIENCE MONTHLY *in November.*

THE funniest experience I ever had with a Model T took place in a small New England town in 1943, while I was attending high school. It was during the last football game of the season. Our team was to this point undefeated, and the game was for the regional championship.

My Model T was parked on the fifty-yard line. It was a 1927 touring car. As the game got into the last quarter, the crowd was in suspense. The score was a tie. Three schoolgirls were sitting in the front seat. I was sitting in the back with other friends. Suddenly, the girl in the driver's seat decided to see if she could start the car. It was equipped with a self-starter and didn't need to be cranked. During the excitement of the game, one of the girls had knocked the switch on Battery. Also the hand throttle was more than halfway down. As the girl stepped on the starter, the car started to cross the ball field. The driver got panicky. We were half across before I managed to get at the wheel and turn it towards the goal post, as there were no vehicles parked there, nor were there any spectators. I looked behind us to see the captain of our team running towards us with the football in his hands. I knew he was also heading for the goal to make a touchdown. He stayed close to us, and managed to make the goal without too much trouble. After the game, I found out that the game was a loss to our team due to "interference of the spectators."—*Frank H. Corson, Highland Park, N. J.*

Please turn the page for more Model T stories.

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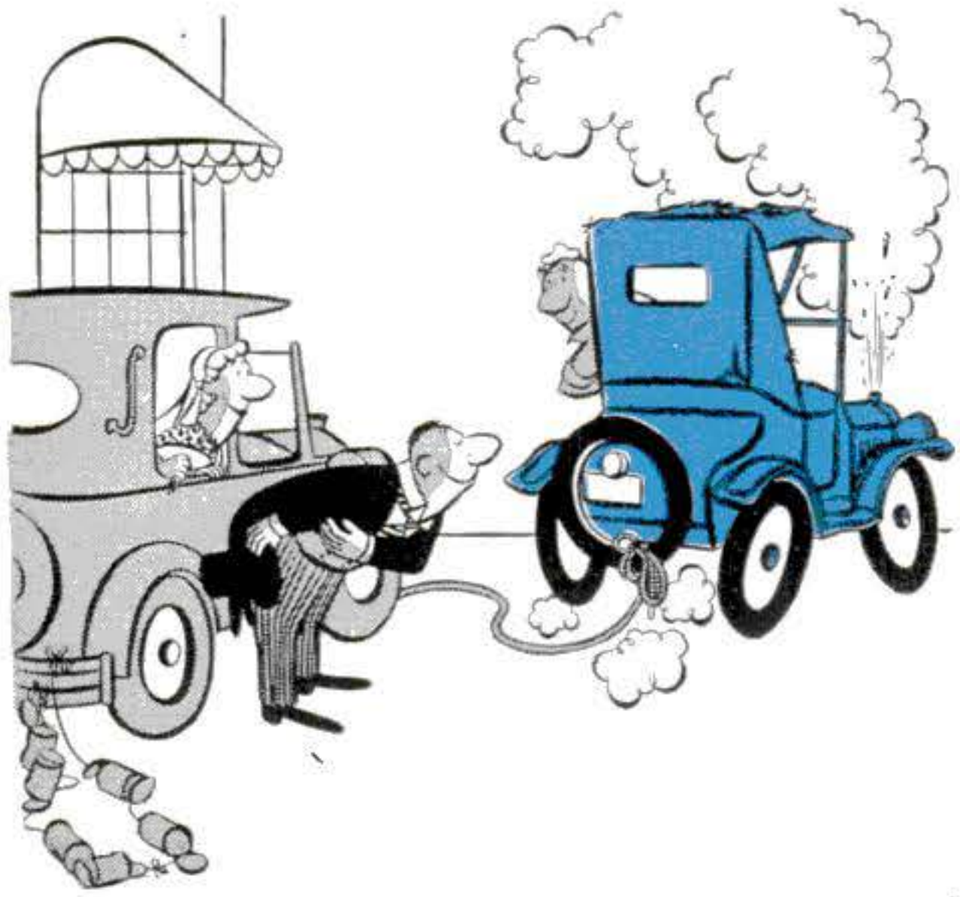
MY FUNNIEST experience with a Model T Ford was not a personal experience but happened in our neighborhood when I was a kid. Our neighbor had two teen-age sons, who wanted their father to buy a car and used as their argument the fact that they could drive him to work and pick him up each afternoon after work. The old man, on the strength of this, bought a Model T, but after two weeks of driving Dad to and from work, this chore became tiresome and the boys became lax, so the old man decided to learn to drive himself and told his son Louie to pull the car out of the garage in preparation for his first lesson. Louie did. I do not know whether the old man, in getting in, pushed the reverse pedal, but when Louie cranked the car, it promptly backed into the garage and hit the rear wall. Whereupon, the old man jumped out of the car, shouting, "See there, Louie. You cranked 'er backwards."—*James B. Ross, Butler, Pa.*

AT A swank golf club reception, the bride and bridegroom's spick-and-span, chauffeured Cadillac limousine, with wedding paraphernalia dangling from the rear bumper, stalled in the club's driveway and had to be towed to the clubhouse. As a young caddie, I did



the towing job with my badly battered Model T roadster—motor roaring in low, capless radiator steaming, and exhaust sending up clouds of black smoke.

Arriving thus, much to the amusement of some 200 assembled merrymakers, the bridegroom quickly turned this trying situation into triumph. "Young man," he said, bowing low, "I salute you! Of all my distinguished guests, only you thoughtfully tied a tin can to the *front* end of my car."—*Jack Ginster, Manassas, Va.*

PROBABLY the most exciting escapade of our 1925 Model T happened while on a trip through the New England States. It is, as you know, rather hilly in New England, and in those days the roads were rather narrow. The only serious worry my father ever seemed to have was of having a flat tire on a narrow, curved road on a hill.

As luck would have it, after running most all day and with night falling, we had a puncture just as we reached the summit of a hill. Well, before my father reacted, we saw the front tire rolling down the hill, so he decided to try to make it on three wheels. Incidentally, the car didn't tip to the rim. I remember well because the tire came off on my side. I guess I was too small to throw the car off balance.

As we rode down the hill, the whole family was wide-eyed to see where the tire had stopped. As we approached the bottom, we saw a garage with a mechanic eagerly trying to repair a tube. A tire was at his feet. Naturally we stopped, and in a very casual manner the mechanic said, "Great car, that Ford. It even sent its own tire in for repair."—*Lewis P. Orchard Jr., Berlin, N. J.*

JOE, a customer of mine, had had several Model Ts stolen, and had very little faith in the numerous car-locking devices we tried to sell him. He devised a method for locking his most recent Model T that he felt was foolproof.

He passed a heavy anchor chain around the rear axle of his car, then locked this securely to a telegraph pole that was located in front of his house. It worked fine, until one evening Joe came home accompanied by a friend. They were both in a very carefree mood,

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having imbibed rather freely of the local bathtub gin.

When they alighted from the car, Joe's generous friend crawled under it and fastened the chain in what he thought was a very secure manner. Later that evening, the boys, feeling the need to replenish their dwindling supply of hootch, reeled out of the house and hopped into the car, completely forgetting about the chain.

The car leaped ahead with a roar. The chain, with more than its usual amount of slack, ran out its length and then, with a horrible rending of metal parts, snatched the whole rear axle out from under the poor Model T.

As the car shivered to a stop, its hind end resting on the ground, Joe's friend peered back at the rear axle, still securely chained to the pole, and said, "That chain sure keeps them from stealing that rear axle, doesn't it, Joe?"—*Harold R. Svenson, Long Island City, N. Y.*

MY LITTLE boy was cranky and cutting teeth and would not go to sleep. I did everything I could think of, and still no sleep. I went outside and cranked the Model T Ford. Then I got the baby. I could not drive. I just sat in it with him. In two minutes he was asleep.—*Mrs. Minnie Connerton, Tacoma, Wash.*

BACK in 1925, I was selling cars for a living in a little mountain town. We had just gotten in some new 1925 Model T Fords one day, when an old man from back in the hills came in to buy one.

I took him for a ride in our demonstrator, and we drove out into the country. He was sitting in the back seat and asked me a question. I looked around to answer him and ran into a tree on the side of the road.

It shook the old man up a little, as well as myself. I started to explain about the mishap, when the old man interrupted me, saying, "I will take the car, but there is one question I want to ask you."

I said, "Go ahead. Ask me anything."

"All right then," he said, "how do you stop this thing when you don't have a tree to run into?"—*John A. Rae, Chatsworth, Ga.*

MY FUNNIEST experience happened as I was on my way home from a dance.

The pin dropped out of the timer roller in my Model T. Such a place for this to happen! The road home was a narrow dirt road along the river, which was at flood

stage, covering the road with 12 to 18 inches of water. Sitting there figuring how to get at repairing the damage, I had the happy idea of climbing over the windshield to the mudguard. Raising the hood, I found the missing part, replaced the pin, then climbed back over the hood and windshield. Settled comfortably again in the driver's seat, I was patting myself on the back, saying, "What a smart boy am I! I did it without getting into the water." Then, like a flash, it dawned on me I must get out and CRANK the car.—*Timothy J. Connors, Schuylerville, N. Y.*

IT WAS the summer of 1916. I was all of four; my brother, two. I was very small for my age, and weighed the same as my brother, so we looked like twins as we rode behind our parents in our 1915 Model T along a beautiful stretch of graveled country road one Sunday afternoon.

Suddenly alongside us came another Model T, the driver challenging Dad to a race. Agreed. Down went the gas levers

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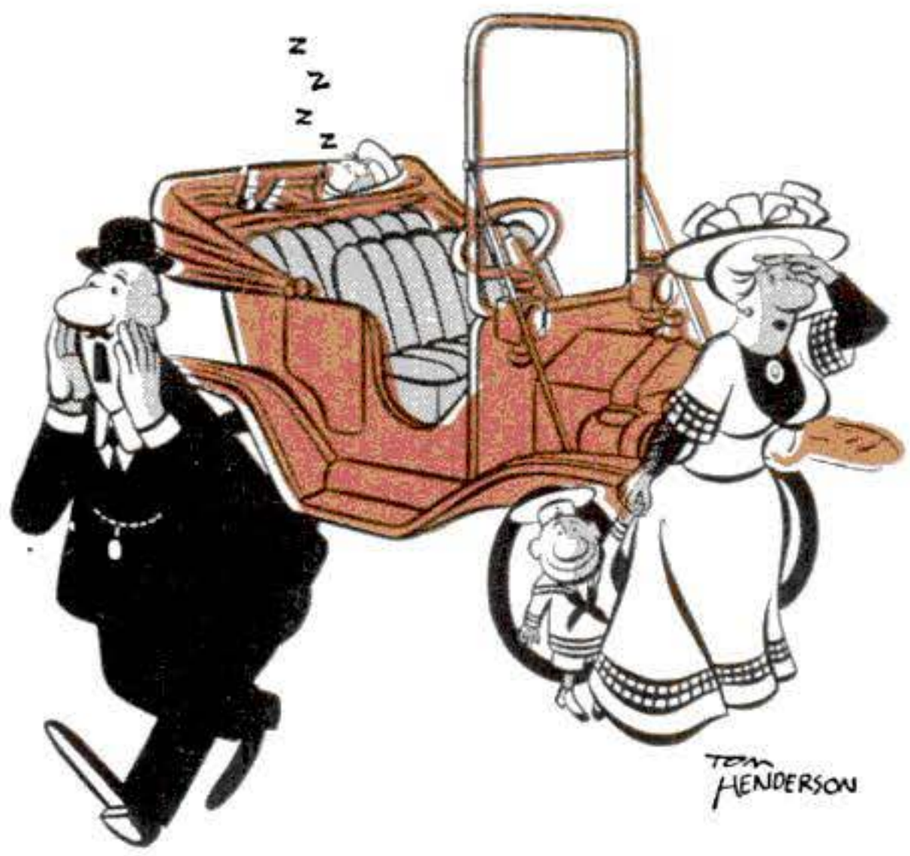

and away we roared in a cloud of dust.

After a couple of miles of this furious pace, Mom glanced around. To her horror, she saw that one boy was missing from the back seat.

The race was forgotten immediately and Dad turned the car around to search for me, probably lying bleeding and broken somewhere back along that bumpy, dusty road. Every foot of road was gone over, but no boy was to be found. What could possibly have happened to me?

After a fruitless search of the vicinity, Mom thought to give the car a thorough going over, and discovered me deep in the pleats of the folded-down top, peacefully sleeping in this unusual hammock, where I had been thrown as we hit a bump in the road.—*Richard L. Williams, Dimondale, Mich.*

MY PARENTS were bowling merrily along a country road in their Model T when they came up behind another Ford of the same type as their own, though evidently much more ill-used, since it was dirty and dented.

Suddenly the Ford in front of theirs turned into a lane, without offering warning of any kind by its driver, and the two-wheel brakes on my father's car, not being up to the occasion, allowed my parents and their car to plow into the rear end of the car in front.

When the dust had settled, a large, red-faced and overalled man, obviously a farmer, got out of the other car and stormed back toward Dad, his eyes flashing fire.

"Ya dern fool!" he roared. "Don'tcha know I allus turn in here?"—*J. D. Hill, Ebensburg, Pa.*

OUR family arrived at Uncle Jim's and Aunt May's in response to their letter inviting us to see the new addition to their family. To our wonderment and awe, we were led to the stable, where we gazed not upon a newborn babe but at something far more unique, a brand-new Model T Ford.

Later, Aunt May decided to honor me with a ride in the Model T. Her answer to my tactless question was "Of course, I know how to drive as well as Uncle Jim. I accompanied him on every lesson he ever took."

We planned to pick up a friend for the drive, but at her house we did not stop, even though Aunt May yelled, "Whoa, Daisy, whoa!" Daisy had always responded, but not this iron steed.

Frantically, we drove on and on. Finally, Aunt May's fear and anger turned to triumph as she said, "We'll just keep driving around the square till we run out of gasoline."

It was thrilling to see our many friends who had gathered at a safe distance, gazing with a mixture of wonder and admiration.

After many rounds the car gave a jerky shudder, and Aunt May said, "We are nearly out of gas. We'll head for home."

We made it to the stable door and stopped, but a last drop of gasoline must have made possible that final cough and lunge which took us into the stable without waiting for the formality of the doors' being opened. Only a sturdy and stubborn old bobsled, stored at the end of the stable, ended our famous ride.—*Mrs. H. W. Grieb, Findlay, O.*

...Next month: The Grand Champion of Model T Stories. Watch for It!

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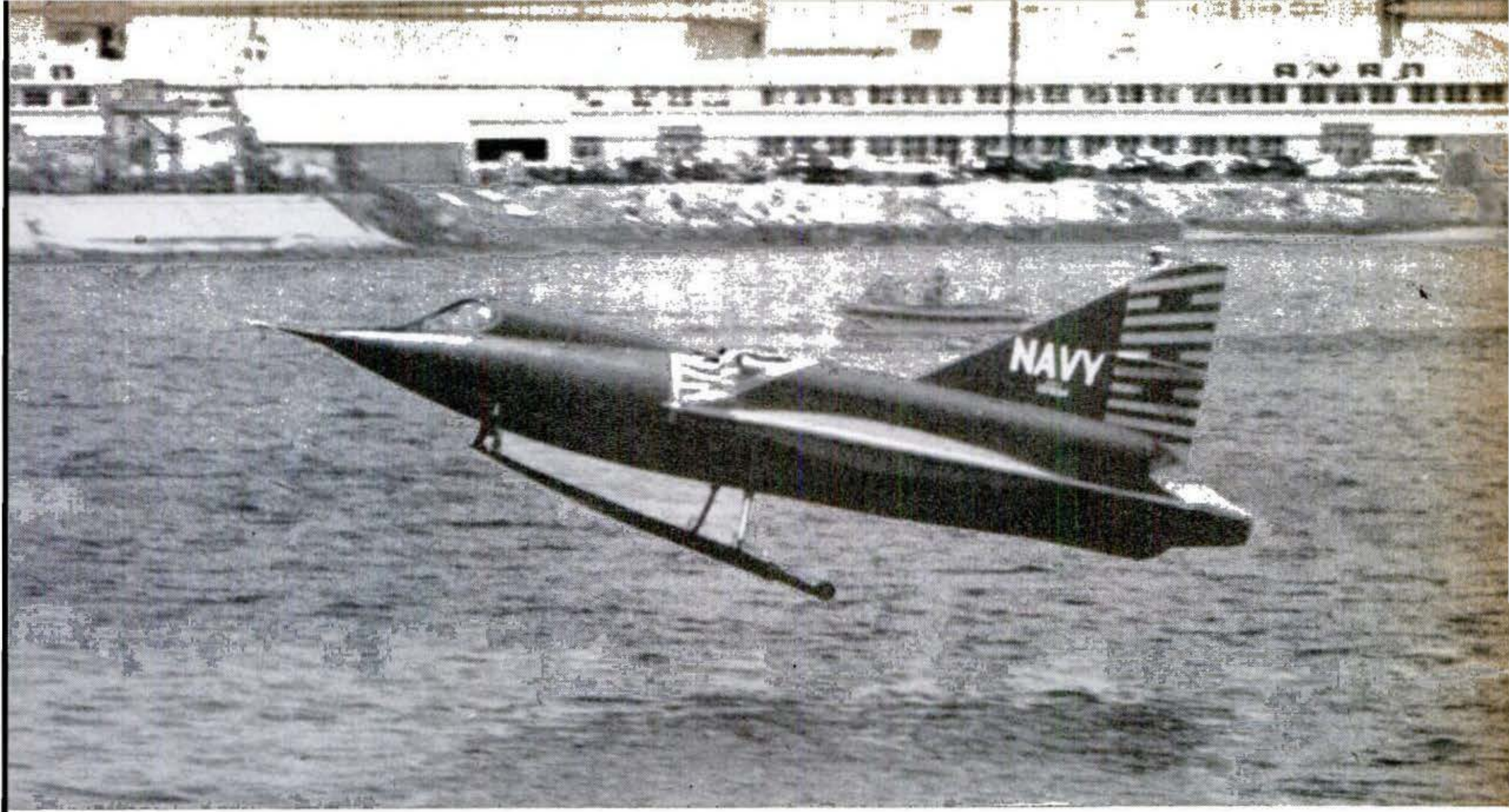


Navy's New Sea-Dart Takes Off Like a Flying Fish

THE Navy's ski plane, the delta-winged Sea-Dart (PSM, Feb. '53, p. 107), has taken to the air in test flights at San Diego, Calif. As shown at left, the skis fold up into the fuselage in flight. Neither the Navy nor Convair, the builder, is saying how fast the Sea-Dart flies, but she was designed for supersonic speeds. The interceptor is powered by two jet engines.

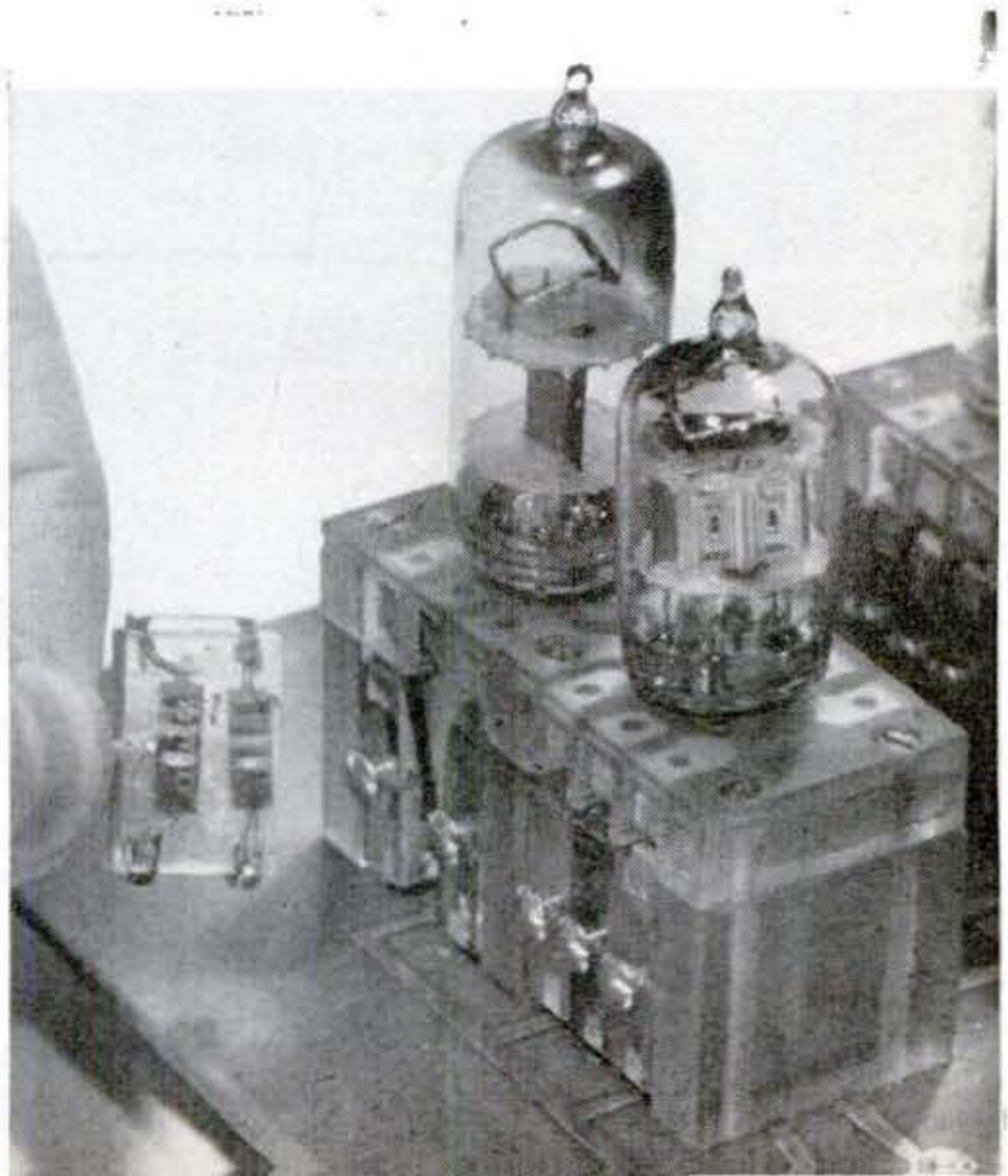
▶▶▶Learning to breathe like a frog is allowing some polio patients to escape from their iron lungs for as much as 14 hours. The trick is to use the tongue as a pump to gulp mouthfuls of air into the lungs.

Outboard Rides on Two Hulls

LIKE a South Seas catamaran, this speedy craft has Siamese-twin hulls—but she's pushed along by an outboard motor rather than the traditional sail. Built in Miami, the boat's called a Catacraft.

Block Circuits Have No Wires

ASSEMBLED like a building toy, the Bureau of Standards electronic equipment below has its circuit elements molded into plastic blocks with protruding contacts. These are spring-clipped between a circuit-etched base and a plate with tube sockets.



California's Two Big Cities Ponder

Subways in the Sky

ONE day during World War II, while chauffeuring a B-29 bomber on a mission from Tinian Island in the Pacific, a San Francisco financier named George D. Roberts fell to thinking of problems back home. Suddenly he got an idea. As a result, Californians may one of these days be riding subways in the sky instead of bucking automobile traffic that's getting well-nigh impossible.

Single-rail railways, called monorails, rocketing along at 70 miles an hour on great pedestals high above the ground, are his answer to street and high-

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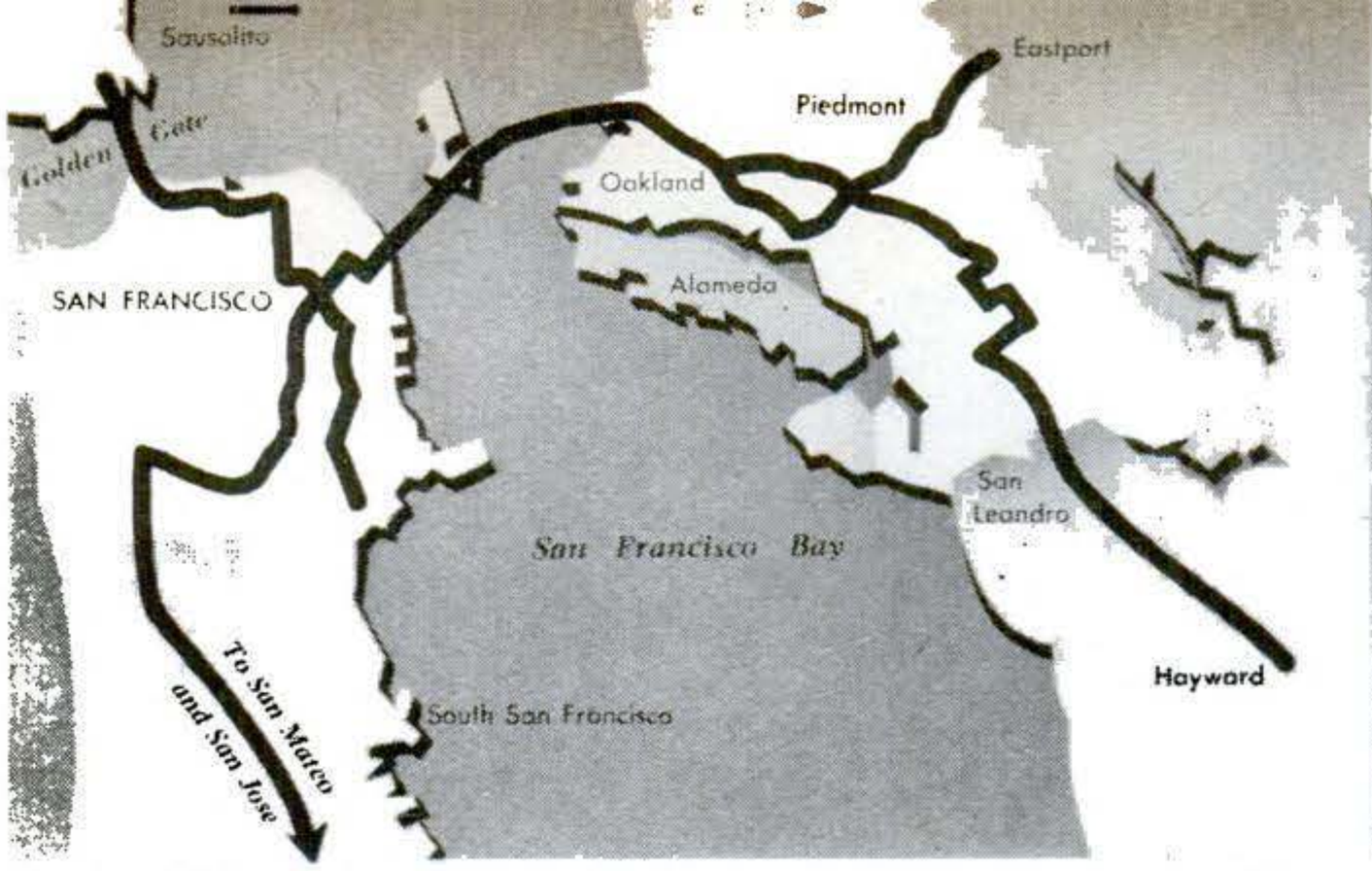
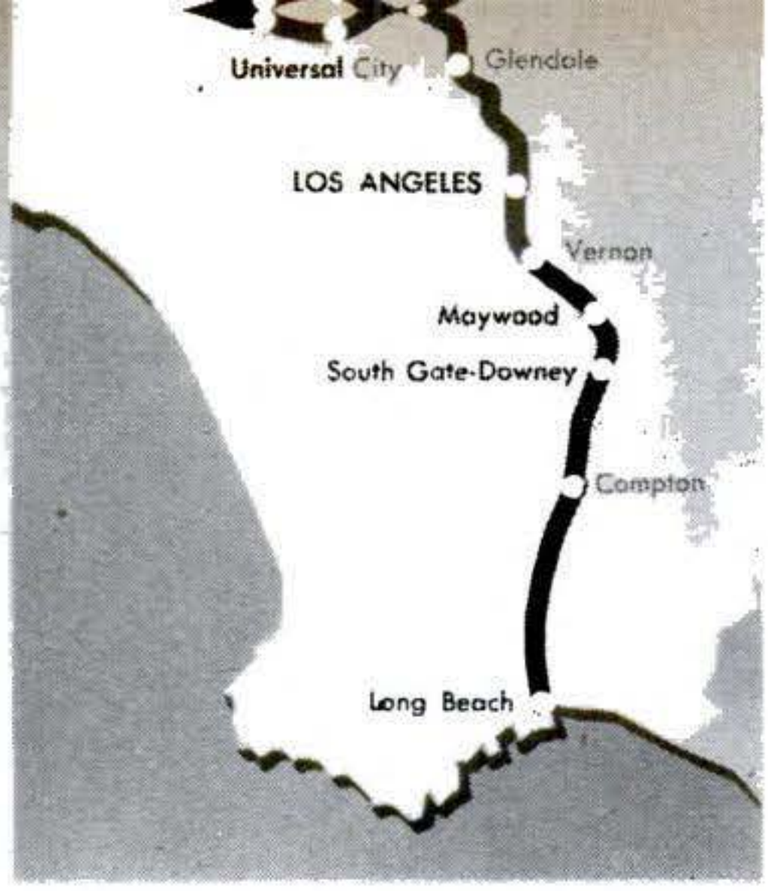


PROPOSED PLAN would operate monorail system in part over bed of Los Angeles River, link Van Nuys with L. A., Long Beach.



BAY AREA NETWORK would connect San Francisco with Oakland and San Leandro, extend south to San Jose, north to San Rafael.

way congestion around our big cities.

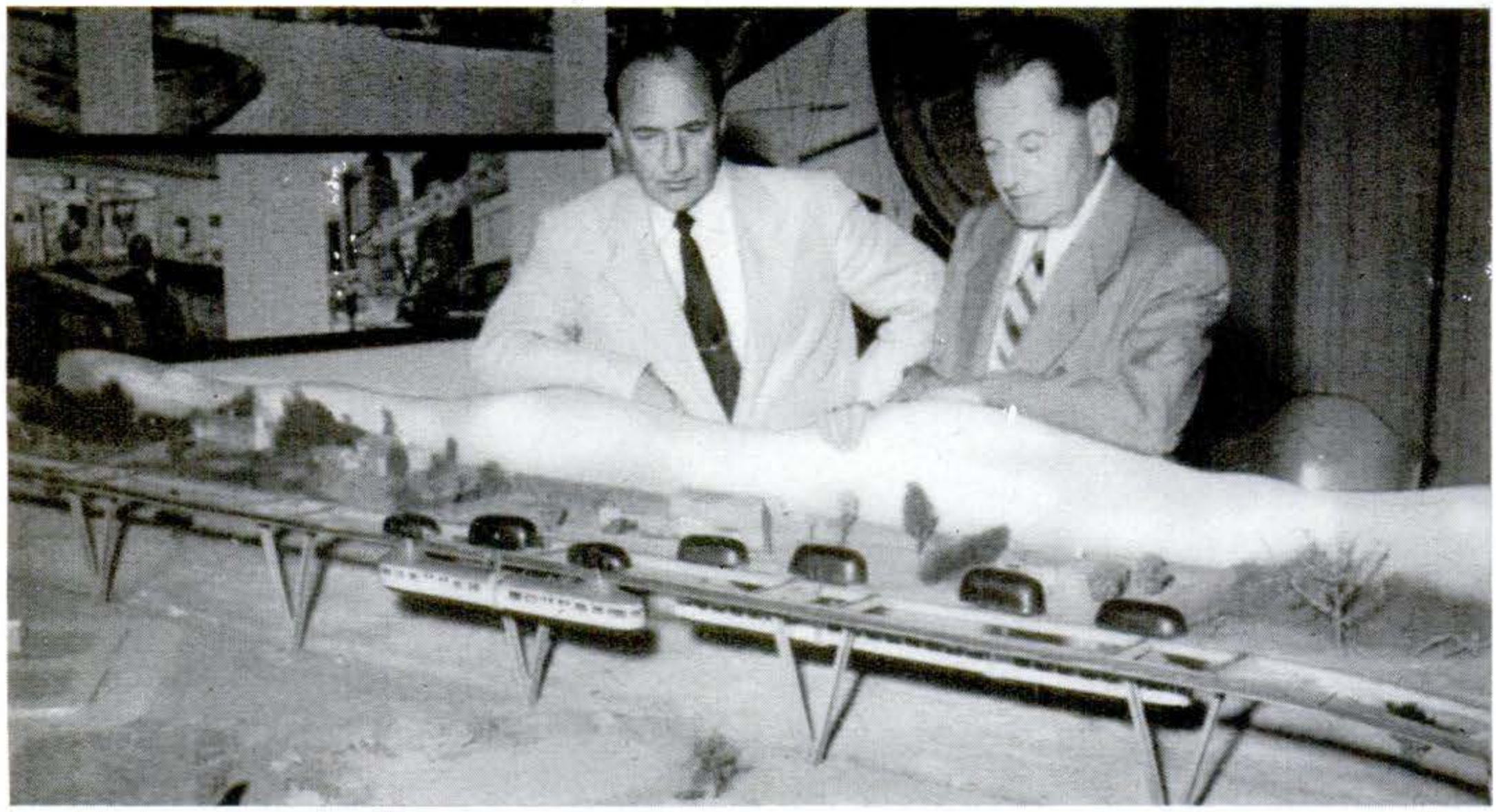
San Francisco may get the first monorail system. Its transit commission is studying the problem. The Los Angeles Transit Authority is considering the construction of a 42-mile line from the San Fernando Valley through Los Angeles to Long Beach down on the ocean.

The San Francisco plan proposes three major lines radiating from an underground turn-around station in the city's heart. Already, schedules have been calculated. Today the eight-mile trip from San Francisco's Civic Center to downtown Oakland takes 30 minutes by interurban and street car, 40 to 45 minutes by automobile. The monorail would do it in 12 minutes, with three stops.

Head of a company sparking interest in overhead transit linking cities and suburbs, Roberts says monorail trains would require a strip of earth only 56 inches wide. A single line of supporting columns would carry trains coming and going. Monorails could run above double-track surface railroads. They could run above the separation strips of divided highways.

Their cost would be a fraction of that spent on subways. And they could be built fast. Roberts says trains could roll in two years after the work began.

PROMOTER GEORGE ROBERTS (right) and an associate, J. U. Lademan, watch model air-conditioned monorail trains whiz by. Aluminum cars would carry 60 seated passengers, 40 standees. Designed with picture windows, cars would ride on inflated rubber tires.



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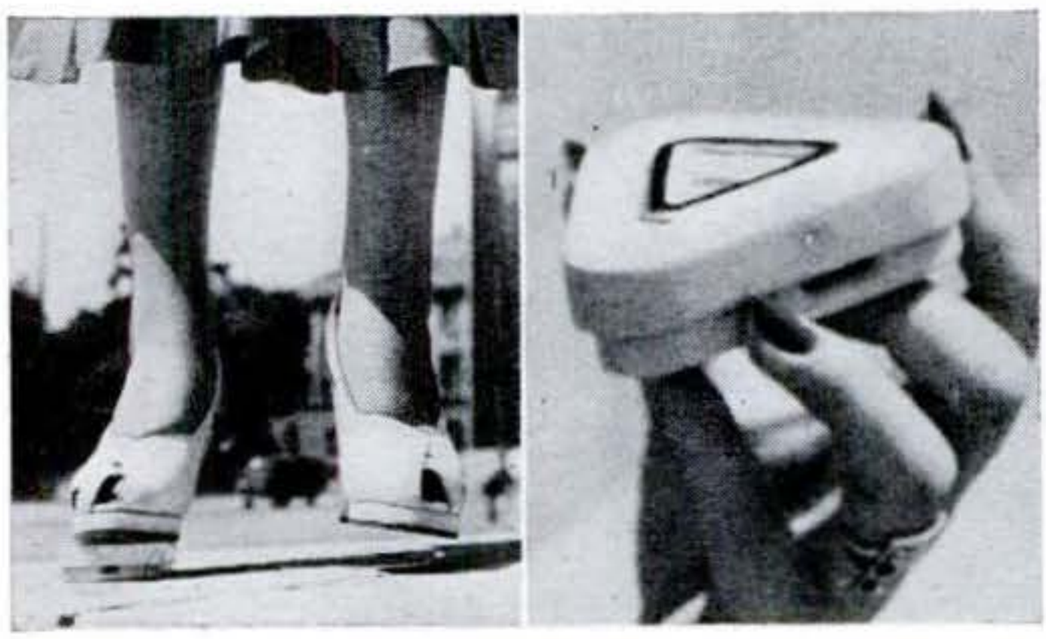
The Generals Ride a Mouse

THIS is Britain's newest army baby—the Field Mouse. A scout car with four-wheel drive, it made its debut at a combat-vehicle show for officers from NATO countries.

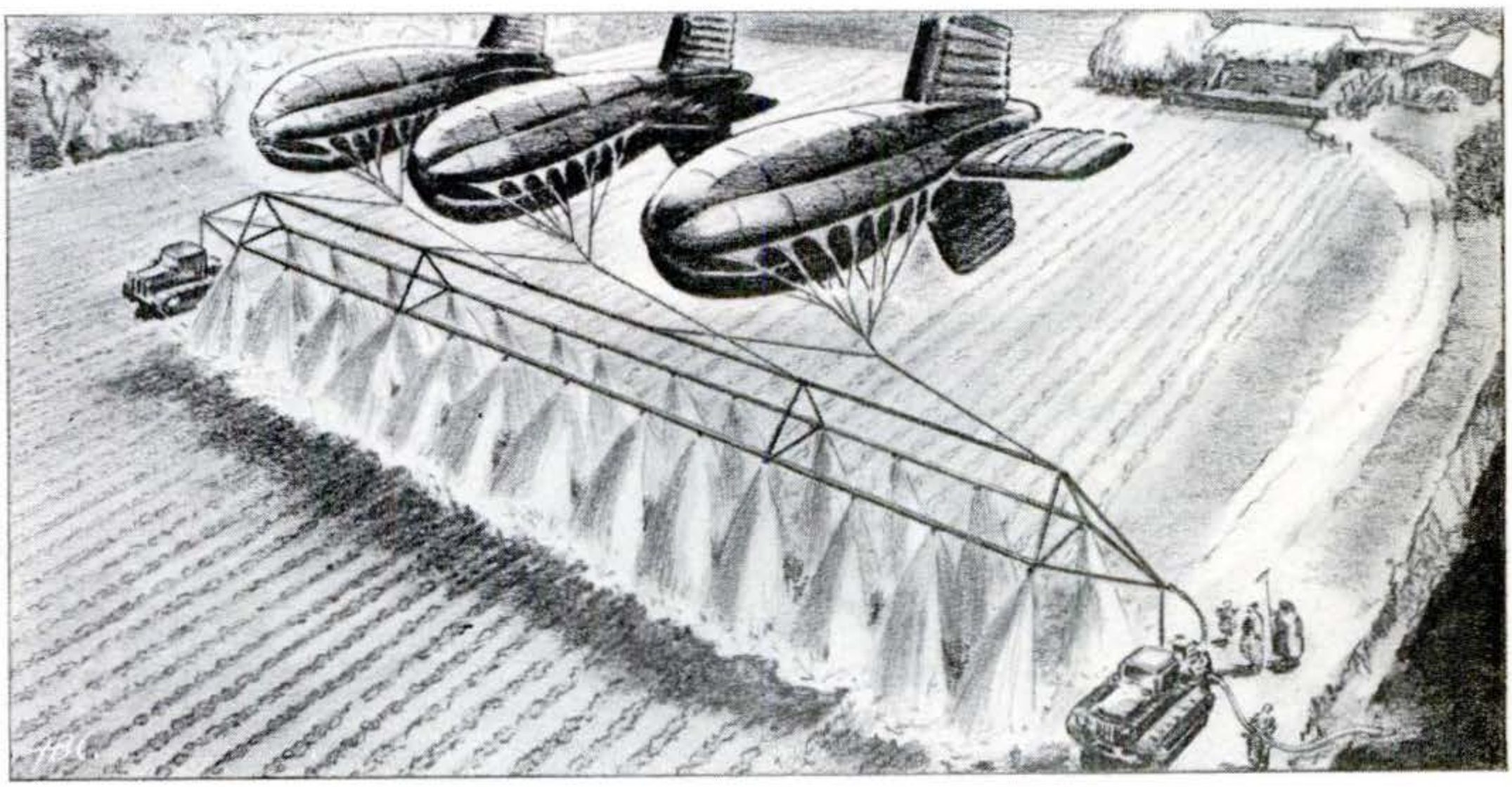


Scale Keeps Weight Secret

FIRST you step on the German scale above, then pick it up and read your weight in privacy through a lens in the side. The dial is then rezeroed for the next user.

Hobby Tunnels House

A PARIS watchmaker built this midget train of French rolling stock. And ran the line right through his basement wall out into the garden.



New Rainmaker Proposed—The Flying Watering Can

HUNGARIAN propagandists say their country is planning to irrigate farms alongside canals with sprinklers hung from barrage balloons. Fed by tractor-borne pumps, the sprinkler would wet down fields 500 yards wide. Flexible pipe linking sprinkler and pumps would allow the balloons to lift the rainmaker over trees.

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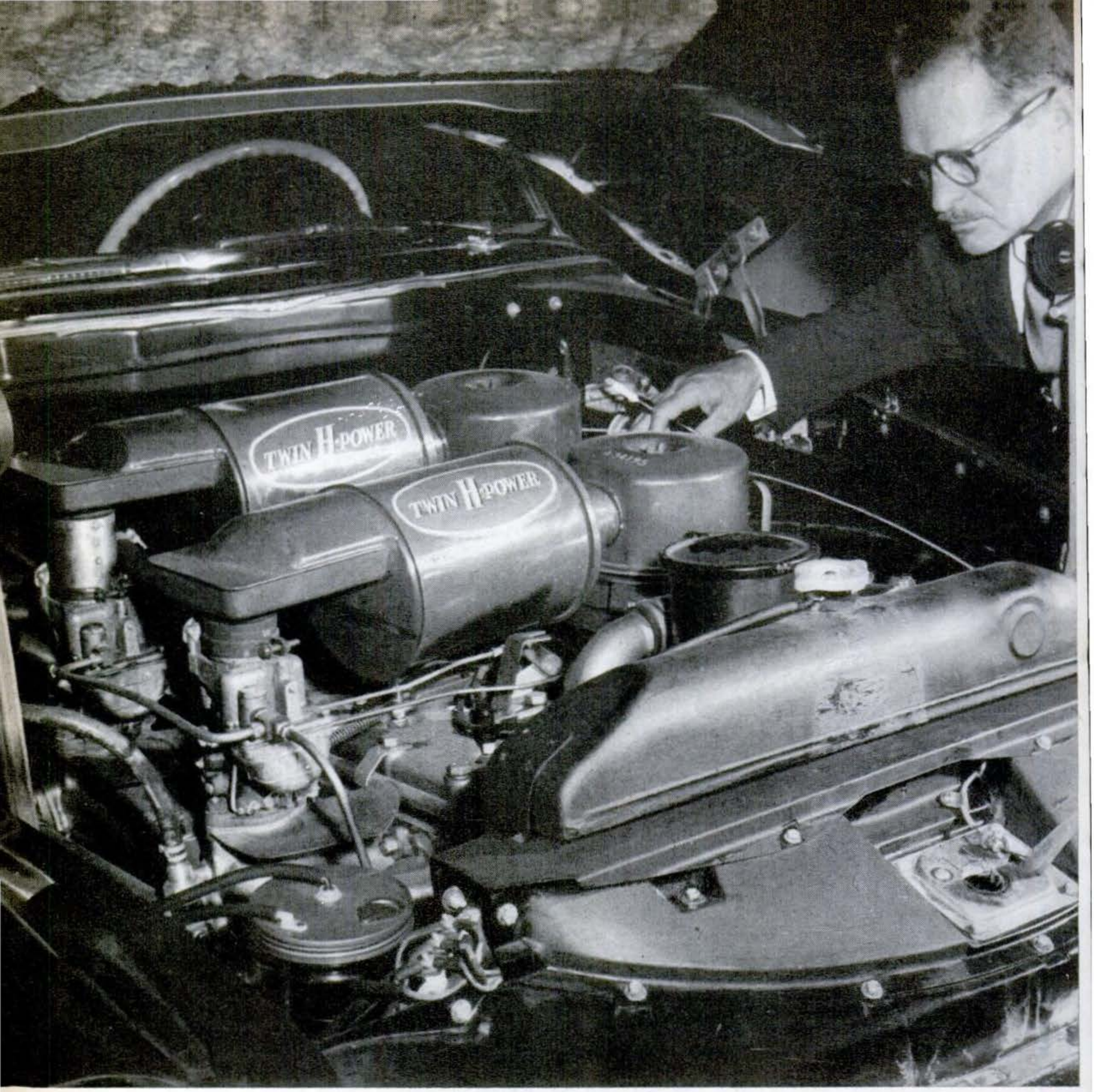

Twin carburetors plus valve changes and higher compression give famous Hornet L-head 170 hp.

EVERY automobile manufacturer in the United States uses an ignition key with an angularly cut head—except Hudson. Hudson's is round. This minor but diametrical difference symbolizes Hudson's attitude toward engine design.

This month I'm going to tell you about Hudson's 1954 Hornet engine. While almost everybody else in the industry is adopting or flirting with overhead valve engines, Hudson is sticking firmly and dispassionately to the L-head.

With twin carbs, the six-cylinder Hornet for '54 has a cool 170 horsepower.

It gets that on nonpremium fuel. Anybody who thinks that the L-head engine is as dead as a dodo evidently ought to have his head examined.

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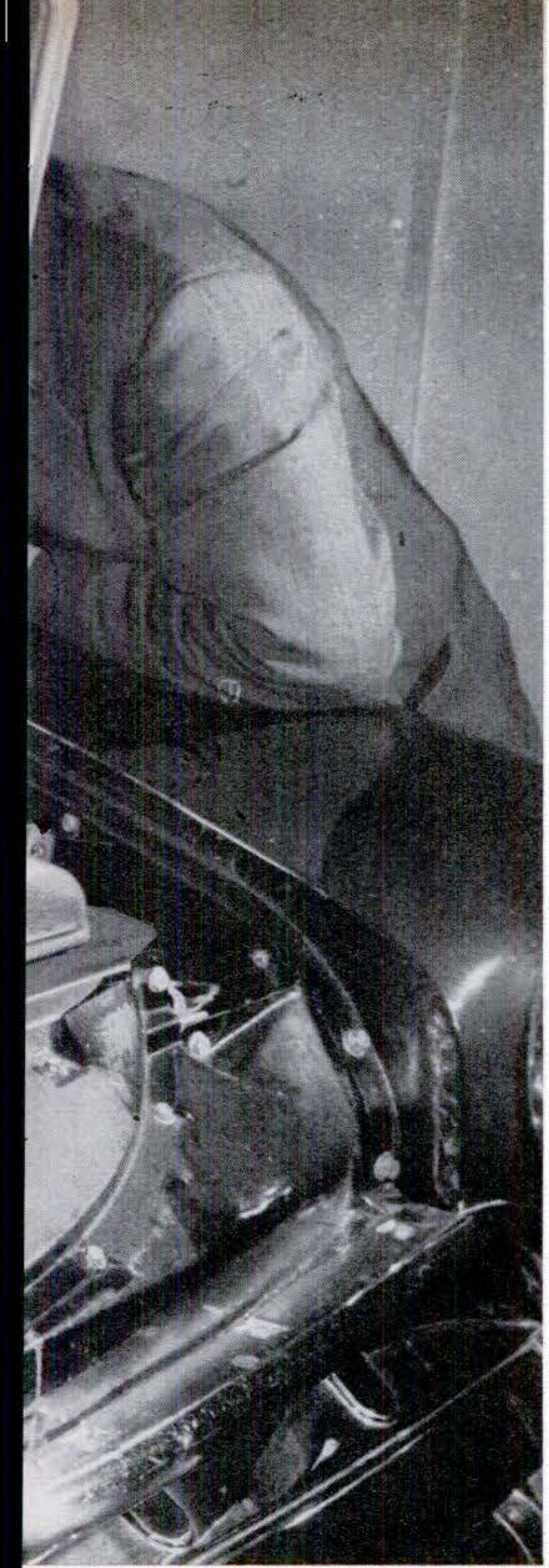

WILBUR SHAW REPORTS FROM THE DRIVER'S SEAT

Hudson Moves Up in Horsepower Race

THE INSTRUMENT GROUPING for '54 is much improved. The power brake pedal is handy. In the photo 'way above I'm holding a 1/16 scale model of the Hornet.

At the wheel of a Hornet equipped with a Hydra-Matic transmission, I reached an indicated 60 miles an hour from a standing start in just 12 seconds. The car topped 80 miles an hour in 22 seconds. That's as good as the performance of most other American automobiles of equal or even greater horsepower. It's a lot better than some of them.

The speedometer was almost on the button. It registered only one mile an hour off on the high side at 60 and three miles at 80.

With the accelerator on the floorboard, the car was still accelerating nicely at 100 miles an hour when I slacked off.

The Hornet accomplishes all this on an "old" long-stroke, L-head engine. How? Well, that's the story.

How Hudson Stacks Up with Rivals

I was curious about how the Hornet stacked up in efficiency against some of the new valve-in-head engines that have made their appearance in the last five years. The figures were surprising.

The Chrysler V-8 gets .54 horsepower out of each cubic inch of piston displace-

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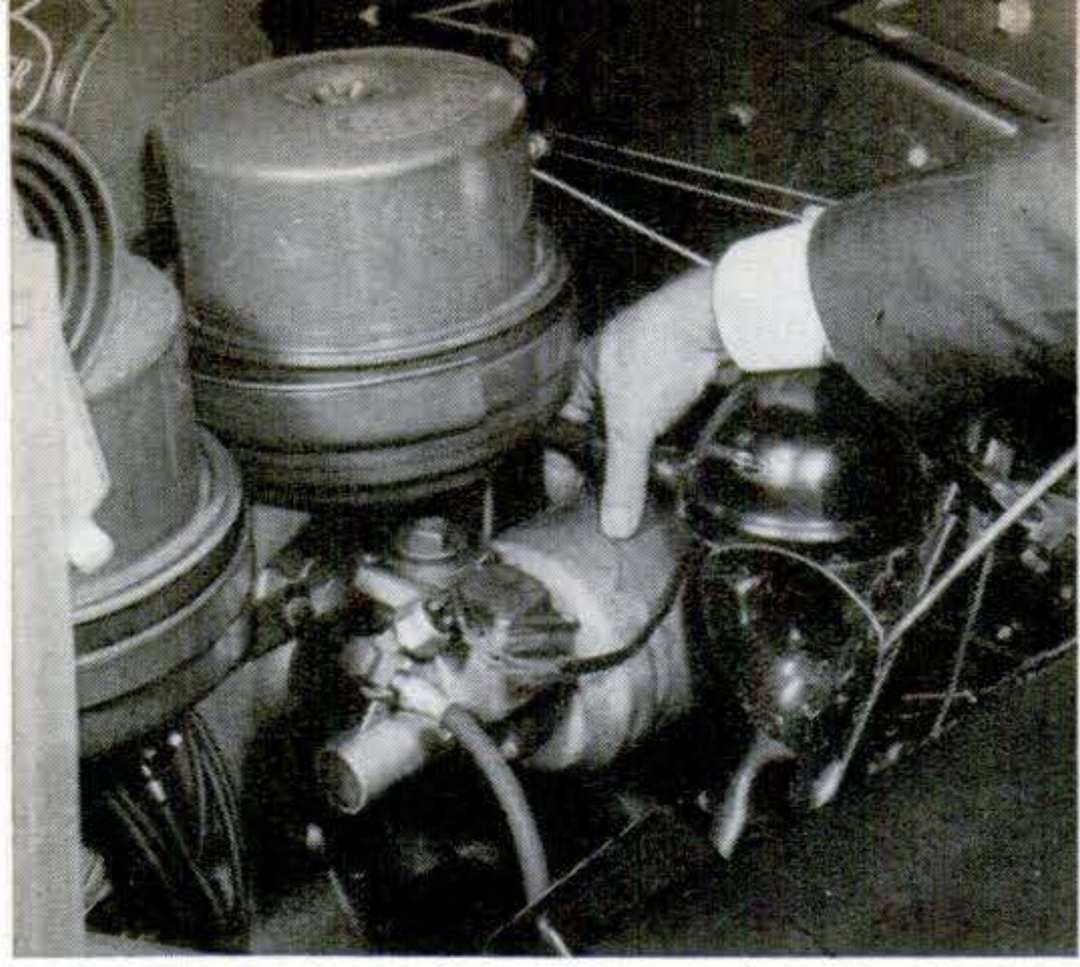
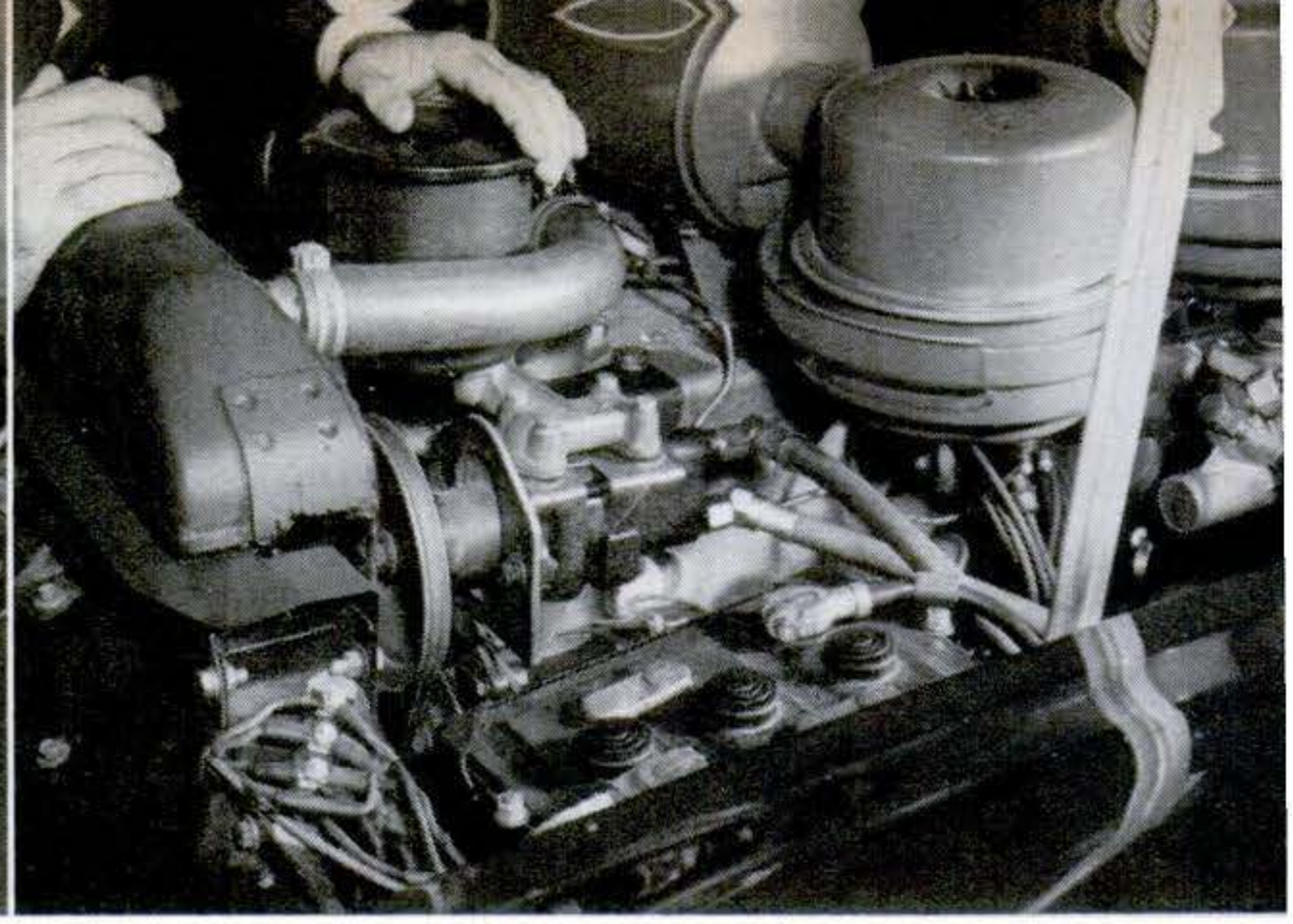


THE MASTER BRAKE CYLINDER and power braking unit are integral. The Hornet's low weight-to-horsepower ratio puts the car in the circle of Cadillac, Lincoln, Olds and Buick.



HERE'S THE OIL RESERVOIR for power steering. Hudson uses the Saginaw linkage type. The maximum effort required is three pounds of pull on a steering wheel 18 inches across.

ment. The Oldsmobile also gets .54 horsepower, the Ford Six .47, the Buick Roadmaster .55, the Lincoln .64, the Studebaker Commander .51, the Cadillac "62" model .63 and the refurbished Chevrolet engine .49.

The Hornet pulls .55 horsepower out of each cubic inch of displacement in its "outmoded" old side-valve. On the strength of the figures, I'd say some of us have been selling the L-head down the river.

From time to time I've written about better "breathing" in my Reports from the Driver's Seat. Essentially that's all that Hudson has done to its '54 Hornet engine—made it breathe better. The gas gets in and out of the cylinders more easily.

Compression Ratio Gets Boost

The bore, stroke and valve sizes are the same as for '53. The valve timing and valve lift are unchanged. Hudson has boosted the compression ratio from 7.2:1 to 7.5. But the principal change, a small one, is in the straightened flow-lines at the valve throats.

A little projection at the throat that the gas heretofore had to jump over has been removed. In addition, the lobes of the cams have been flattened a bit so that the "dwell" at the wide-open position of the valves is increased.

And, of course, two double-barreled carburetors—optional equipment—cascade vapor faster into the intake gallery.

These little changes have had happy results beyond the boost in horsepower. The car's faster. I sneaked a look at the confidential results on one engineering test car that showed a top speed in excess of 115 miles an hour.

The torque peak—and it's torque, not horsepower, that gives you oomph for passing on the highway—is practically constant now all the way from 60 to 80 miles an hour.

The L-head engine has qualities inherent in the design that the overhead valve has to contrive.

The L-head, as everyone knows, has valves that work up and down in an antechamber off each cylinder. The incoming air/gas charge has to turn corners to get into the cylinder. The burned gas has to turn corners to get out.

Champions of the overhead valve engine, where the valves pop up and down right over the piston, insist the OHV is more efficient. The gas doesn't have to turn all those corners getting in and out. What they don't say is that the corners in the L-head provide a natural turbulence in the incoming charge. The gas molecules tumble and swirl like sawdust coming off the blade of a table saw.

And proper turbulence is the main reason an air/gas charge burns rapidly and completely in a cylinder, particularly at high speed.

It wouldn't pay to quarrel with the

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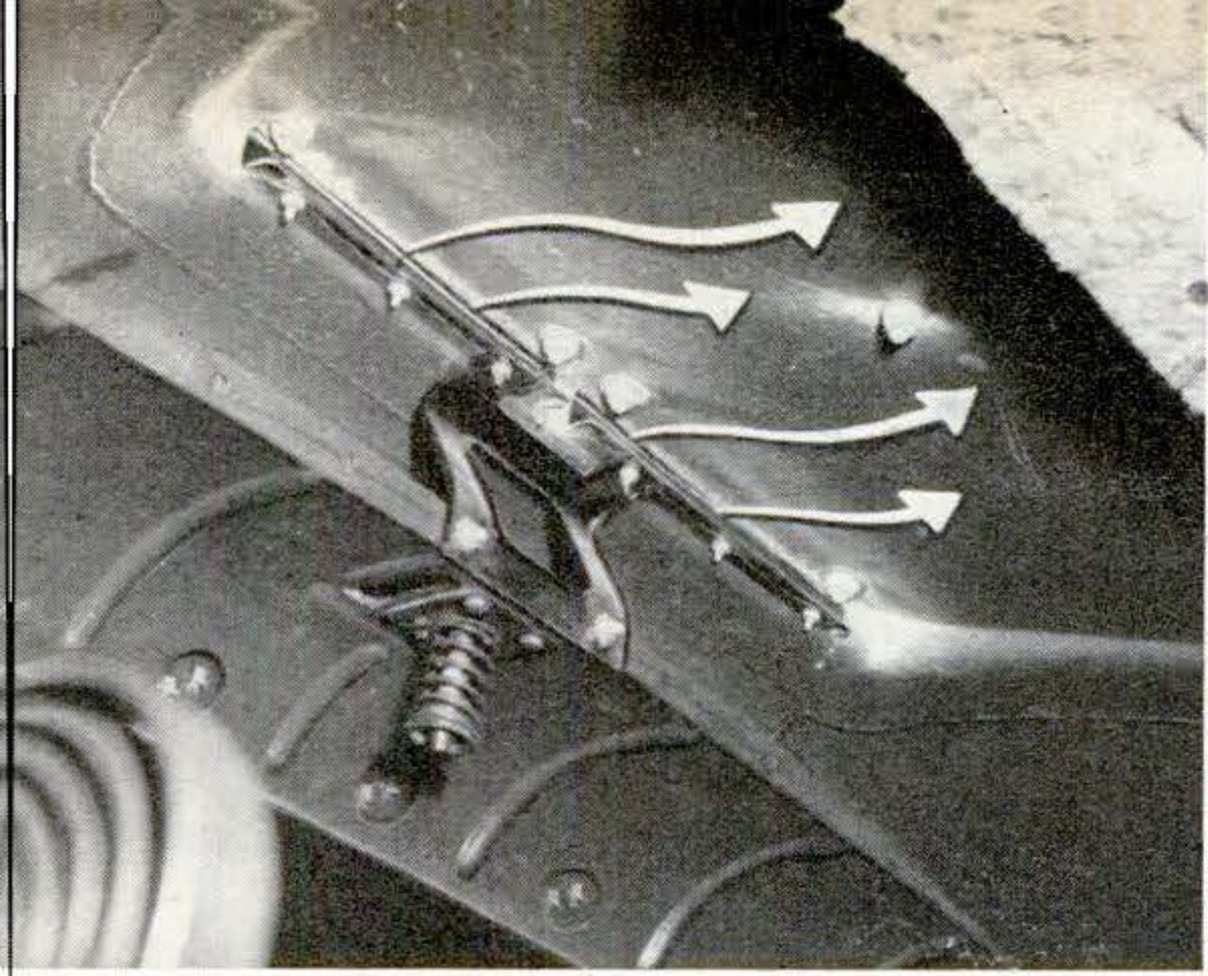

YOU'RE LOOKING up under the hood at the vent feeding air to the carburetors. With **two carburetors, the mixture is leaned out to prevent "flat" spots in accelerating.**

REVISION OF STYLING hasn't affected those racy Hudson lines—nor the ride, as soft as **that of any U. S. car regardless of price. A higher deck lid improves the trunk space.**

OHV people. They've got something. The steadily increasing number of overhead-valve engines in U. S. automobiles is testimony to that. But the case for the overhead valve isn't cut-and-dried. The OHV mechanism is mechanically complicated. One typical OHV six has upward of 120 more parts in its valve system than the Hornet's.

OHV Versus the L-Head

In the course of my visit to Hudson, in Detroit, I remarked to one of the company engineers that automobile racing engines invariably have overhead valves. I was pretty sure what his reply to that would be:

"Sure, but they have overhead camshafts too. Mechanically, the overhead valve and cam—from the cam face onward—is as simple as the valve system on the L-head."

He could also have added that the speed at which racing engines are run assures proper turbulence in the combustion chambers.

The basic Hornet engine was first brought out in Hudson's 1948 models and has been steadily improved. Then it had only 127 horsepower. Its size has been increased—from a displacement of 262 cubic inches to 308. But the design itself has undergone little change. With a single carburetor, the '54 engine delivers 160 horsepower as against 145 in '53. Twin carburetors totted up to only 154 horsepower in '53.

[Continued on page 268]

FACTS ON '54 HUDSON

Model: Hornet 4-door sedan.

Engine: 6-cyl. L-head; 170 hp. (twin carburetors) at 4,000 r.p.m.; compression ratio, 7.5:1; piston displacement, 308 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 1,672; bore and stroke, 3 13/16" by 4½"; torque, 279 lb.-ft. at 2,500 r.p.m.

Weight: 3,570 lb. (approx.); per hp. 21 lb.

Transmission: Hydra-Matic; rear-axle ratio, 3.07:1.

Steering ratio: 25.6:1; radius of turning circle, 20.8 ft.

Effective brake-lining area: 166.3 sq. in.

Springs: front, coil; rear semi-elliptic.

Outside dimensions: height, 60"; over-all length with bumpers and guards, 208 15/16"; width, 77¼"; wheelbase, 124¾"; overhang, front 37½", rear 47 3/32"; tread, front 58½", rear 55½".

Inside dimensions: seat-cushion width front and rear, 64"; leg room, front 43¼", rear 38"; headroom, front 38¾", rear 37¼"; seat height, front and rear 12½"; vertical distance, steering wheel to seat cushion with seat in mid-position, 6⅞"; front seat adjustment, horizontal 4", vertical ½".

Tire Size: 7.10 by 15.

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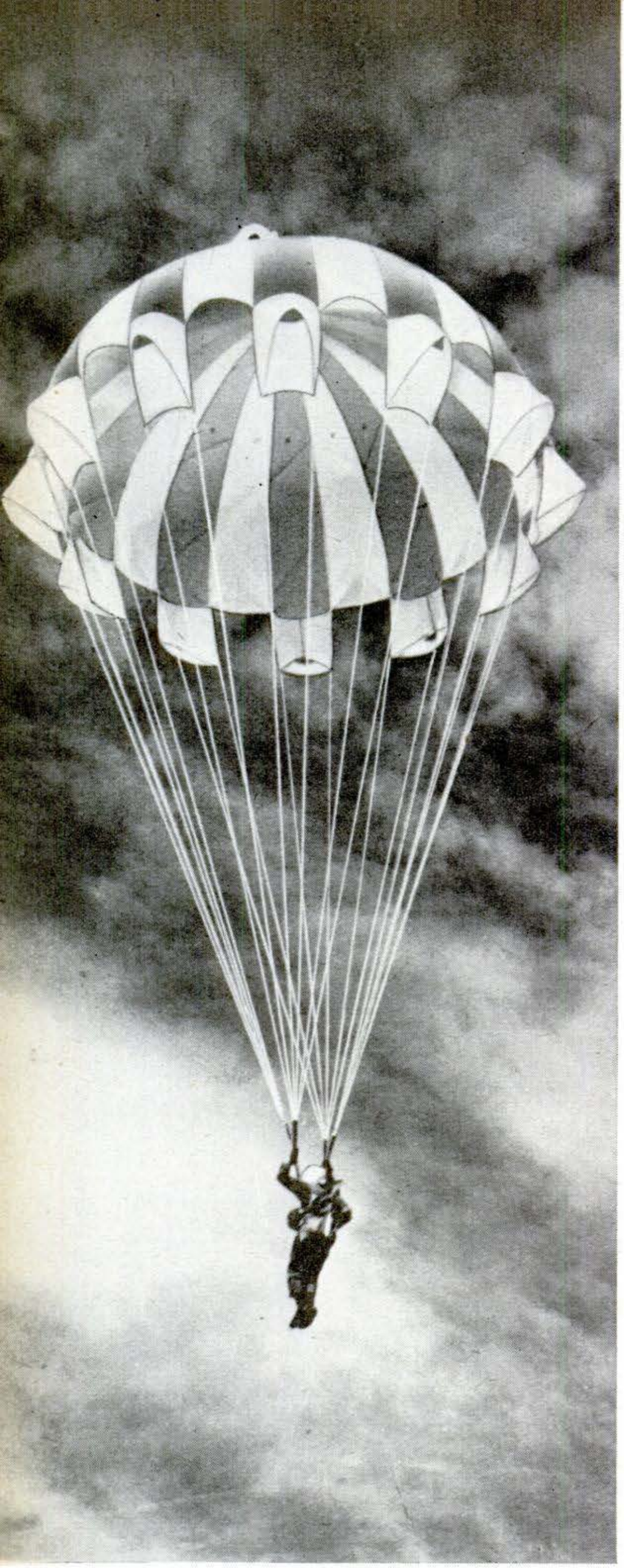
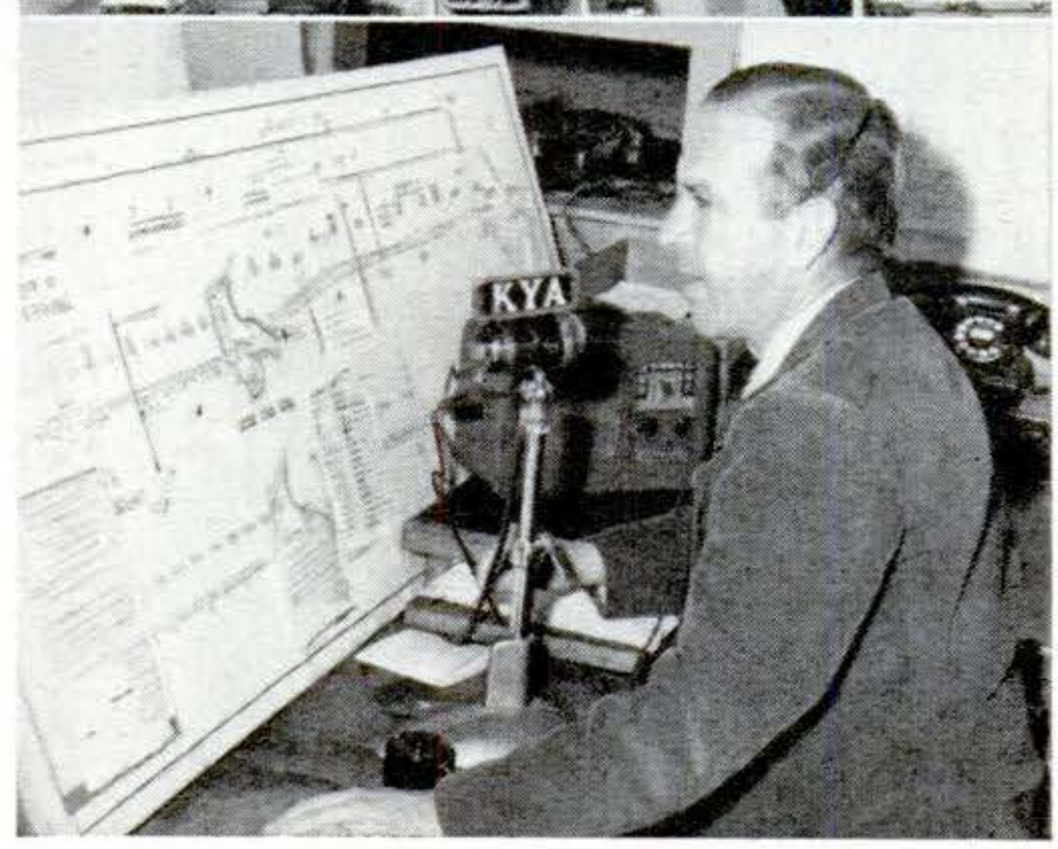


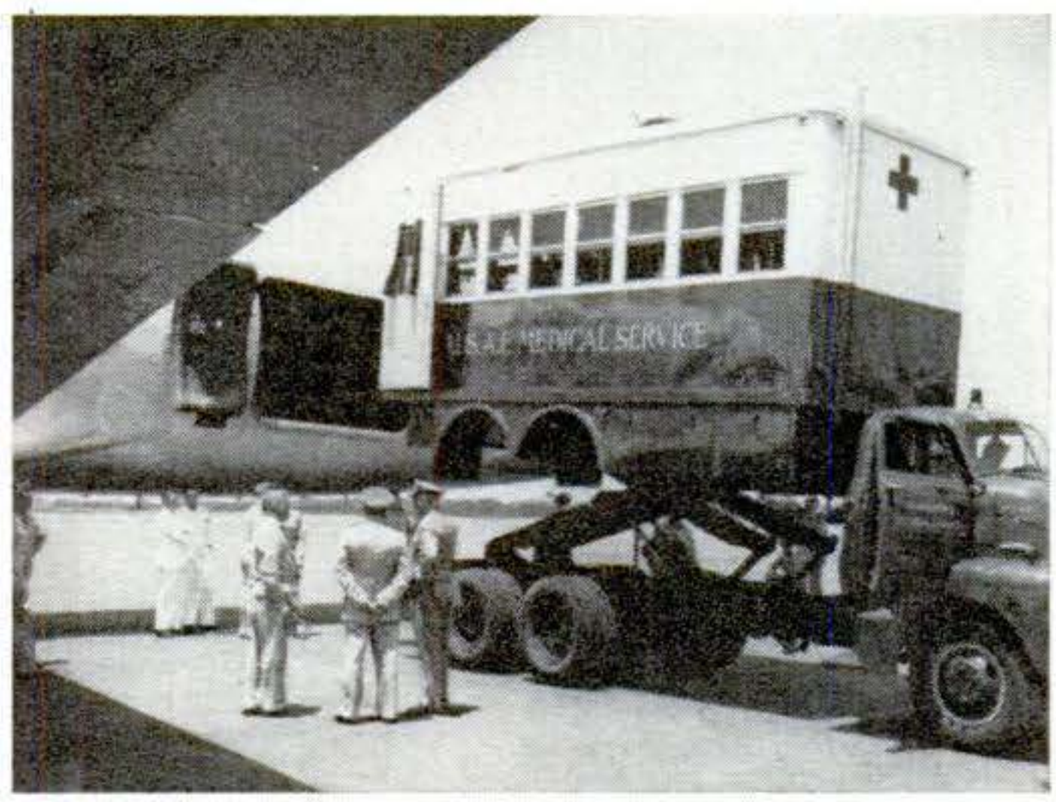
Jumper Lands Like a Cat

A JUMPER drops straight down and lands on his feet with this Pioneer chute. Swaying is cut down by sleevelike scoops at the edges of alternate panels.



Disk Jockey Cuts Crashes

AFTER disk jockey Bert Winn (above) began broadcasting from the bridge dispatcher's office, accidents during rush hours on the San Francisco-Oakland Bay six-mile span dropped 25 percent. Between spinning platters, he warns of tie-ups and makes with safety patter. The reports he relays come in by short wave, phone, ticker tape.



Ambulance Is Its Own Elevator

WHEN this 16-litter Air Force ambulance backs up to an evacuation plane, a built-in hydraulic lift boosts the body into position for loading.

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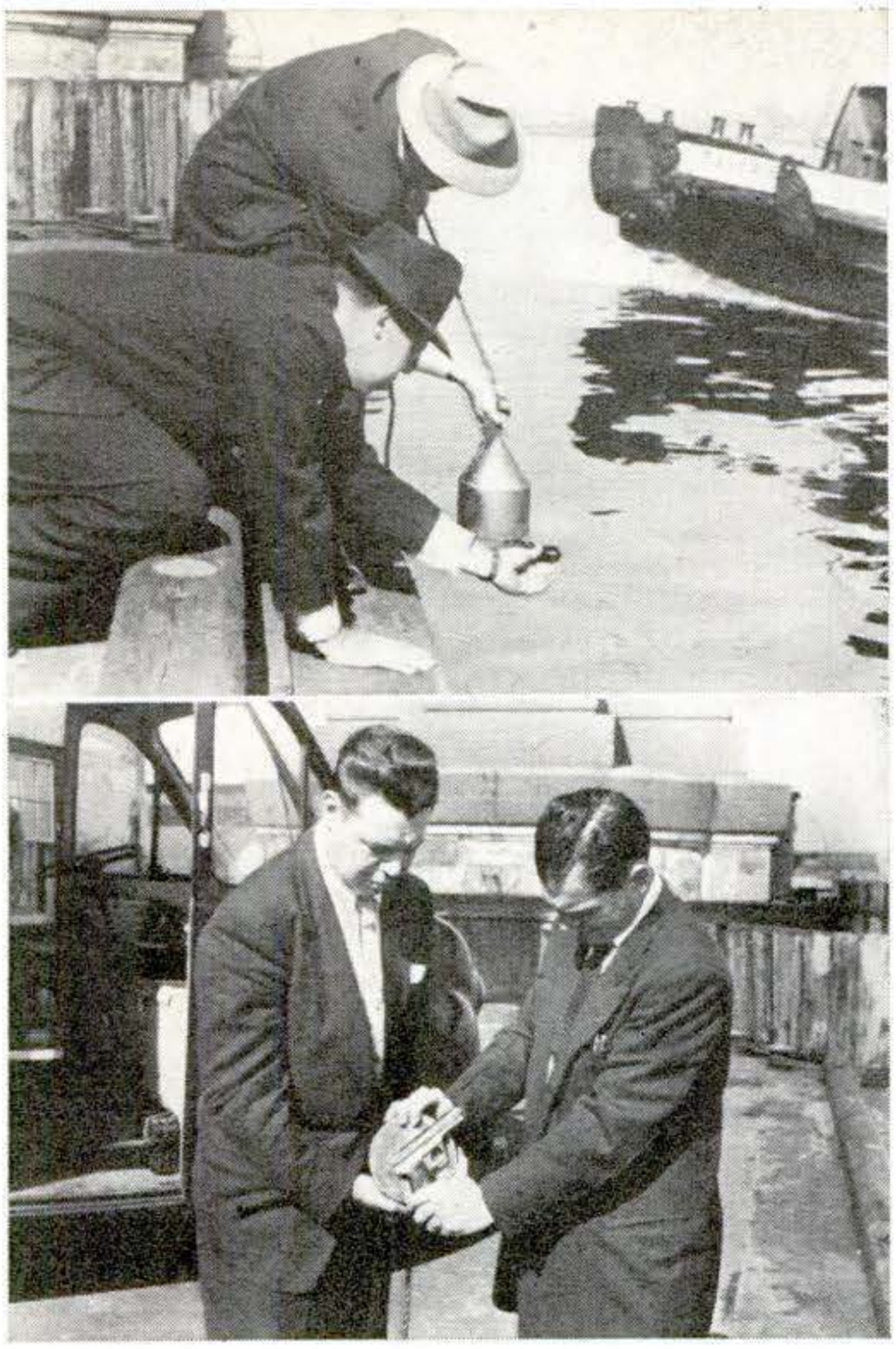
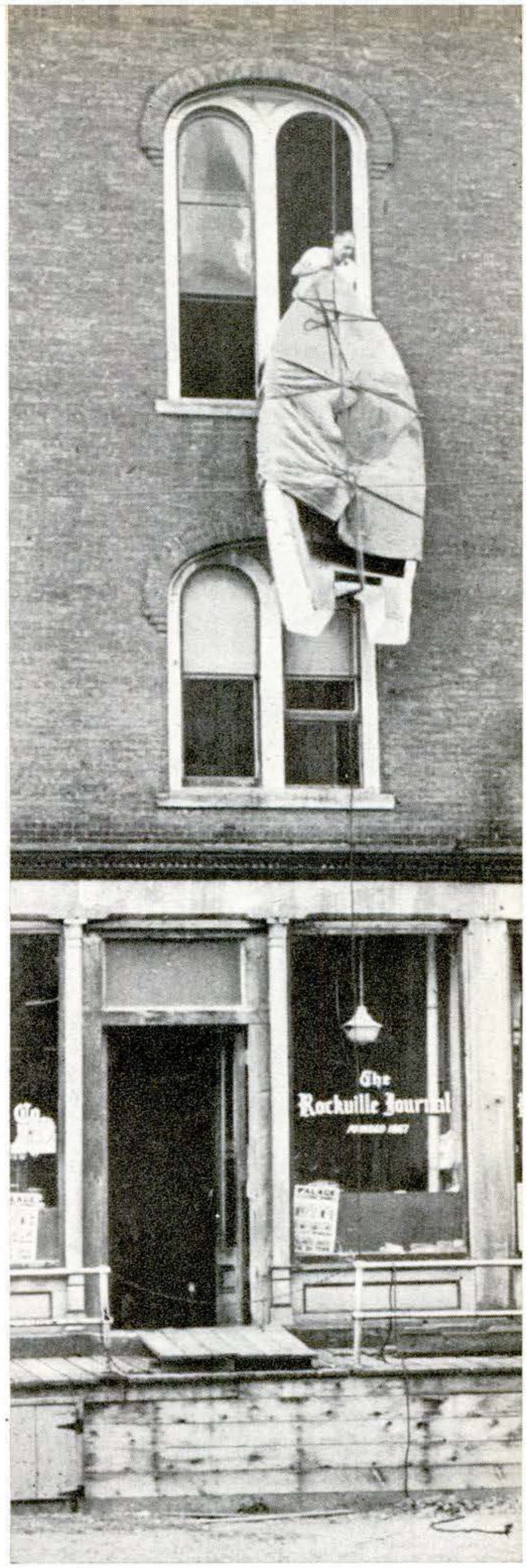


Magnet Gets Murder Gun

THESE Philadelphia detectives are lowering a permanent magnet through 28 feet of river water to recover the gun of a confessed murderer. On their first try they were rewarded (lower photo) with the weapon, empty shell still in the chamber. The Erietz Mfg. Co., Erie, Pa., designed the underwater magnet for the Philadelphia police.

Glasses Step Up 2% Vision

THE near blind can read or view TV with these glasses fitted with ⅜-inch-thick stacked lenses. Dr. R. C. Graham of the Los Angeles College of Optometry devised them.



Boat Launched Three Flights Up

FRANK AUSTIN of Rockville, Conn., knew better than to get stuck with 14 feet of boat in his cellar. He built three stories up and launched the boat with block and tackle.

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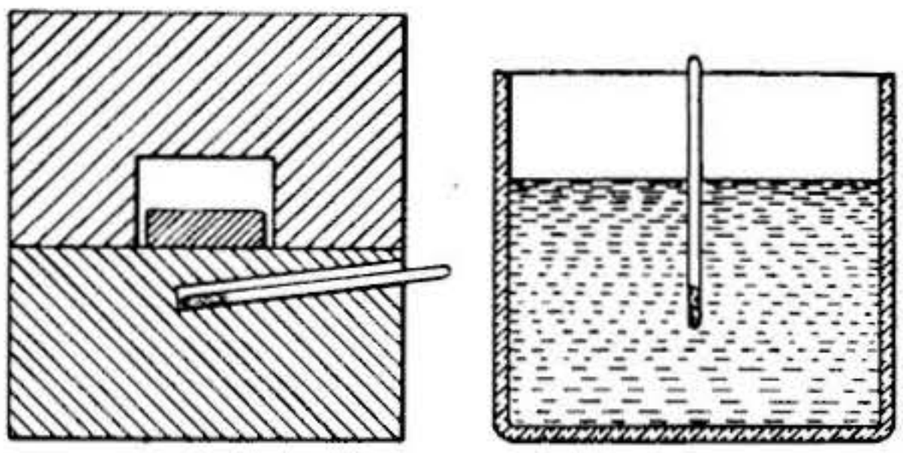
P.S.

Last minute news & notes...

RUSSIAN TV is still way behind the U.S., latest reports indicate. Three stations are known to be on the air (in Kiev, Leningrad and Moscow), with perhaps 100,000 sets in use. The standard receiver is a tiny seven-inch model costing about $300. By contrast, the American public owns more than 20,000,000 receivers, can buy a new 17-incher for $150.

ALUMINUM may be obtained from common clay if a new Bureau of Mines process works out commercially. The clay is heated with lime and soda to separate alumina from silica. Success would end our dependence on imported bauxite ore . . . Four billion barrels of crude oil, now unrecoverable, may be made available by a new method. The oil, too sticky to be pumped, is set afire underground. The heat makes it more liquid so that it flows. Only a small percentage is actually burned. Socony-Vacuum and affiliates are working on it.

FOR A PATENT illustrated only by the two simple pictures below, the U.S. is paying $300,000 to a group of atomic scientists. Issued in 1940, the



patent showed how to make plutonium for atom bombs from uranium. Sketches simply show a neutron-emitter surrounded by a moderator while being used to irradiate something else.

ANY BIG BOMBER can now be a flying tanker, refueling other planes in the air, says the RAF. British experts have developed a hose-reel pack that fits into a bomb bay . . . Many "saucer" reports from radar operators are really echoes due to air refraction, reports a CAA survey--confirming theory of Dr. Donald H. Menzel of Harvard (PSM, April, '53, p. 168).

LOOK FOR a lot more manual-shift cars in '54 among the manufacturers who have been using Hydra-Matics. It's the result of the big fire that razed the Hydra-Matic plant near Detroit last August.

A NEW RIFLE BARREL called the "Micro-Groove" increases accuracy 20 percent, according to the maker, Marlin Firearms Co. Sixteen shallow grooves, instead of the six deep ones in conventional barrels, are designed to impart a more stable spinning action to the bullet.

CANCEROUS WHITE MICE are being flown, a thousand or so every two weeks, from University of Minnesota labs to New York researchers . . . Insects, too, have recently flown to man's rescue on borrowed wings. Millions of ladybugs were airlifted from Montana to North Dakota to attack another breed of bugs eating up the local beans.

WILBUR SHAW'S ANNOUNCEMENT of upped horsepower on the Hudson Hornet (p. 172) is just a hint of what Detroit's planning for '54. Look for spectacular increases in power among the higher-priced cars . . . and, perhaps in 1955, the first major improvement in headlights since the introduction of sealed beams years ago.

THE SKELETON OF A CHILD who probably lived 75,000 years ago has been found in an Iraq cave. Experts believe it to be a child of Neanderthal man, an early type. The cave itself may well be one of the oldest inhabited places on earth. Layers of debris show that it has been lived in almost continuously for 750 centuries--and wandering Kurds still winter there.

The Editors

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My Car Plows Its Own Driveway

Tired of shoveling snow? This homemade plow hitches up your auto engine to do the job.

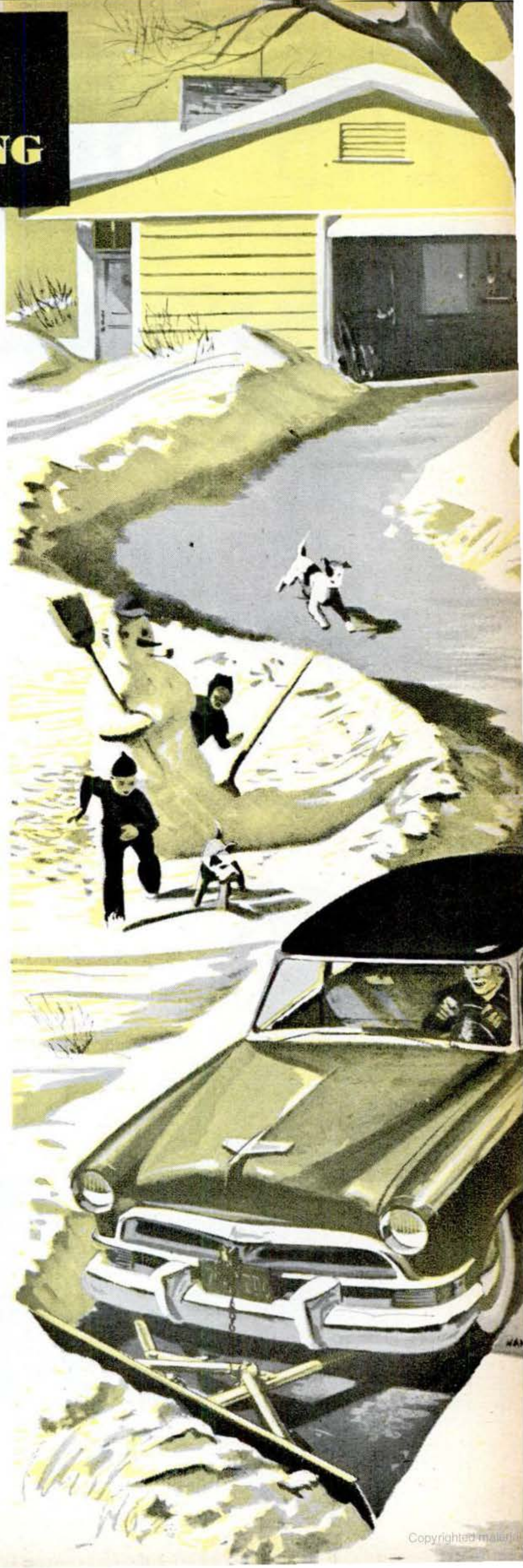
By E. F. Lindsley

ALL YOU can say for snow shoveling is that it's necessary. But one day when I was working up a new set of calluses, it occurred to me that Detroit had put 120 horses under the hood of the car I was breaking trail for. Why not hitch them up?

A couple of weekends and about $21 later I had an auto snowplow and life became easier. The rig can be hooked up to my car, or taken off it, in less than a minute. Unhitched, it's left where I can swing the car up behind it next time the snow flies. All I have to do is lift the hitch sockets to their ball mounts and tighten the clamps. Then I'm all set to clear the snow pronto.

I can even drive short distances with the plow attached. To do this, or to scrape off just the top layer of snow, the blade can be raised by hooking the supporting chain up a few links. Of course it would be possible to rig a rope to do this from the driver's seat, or even install a power hoist, but I haven't found it necessary.

Will the car take it? A plow like this can save you a lot of out-of-breath labor, if



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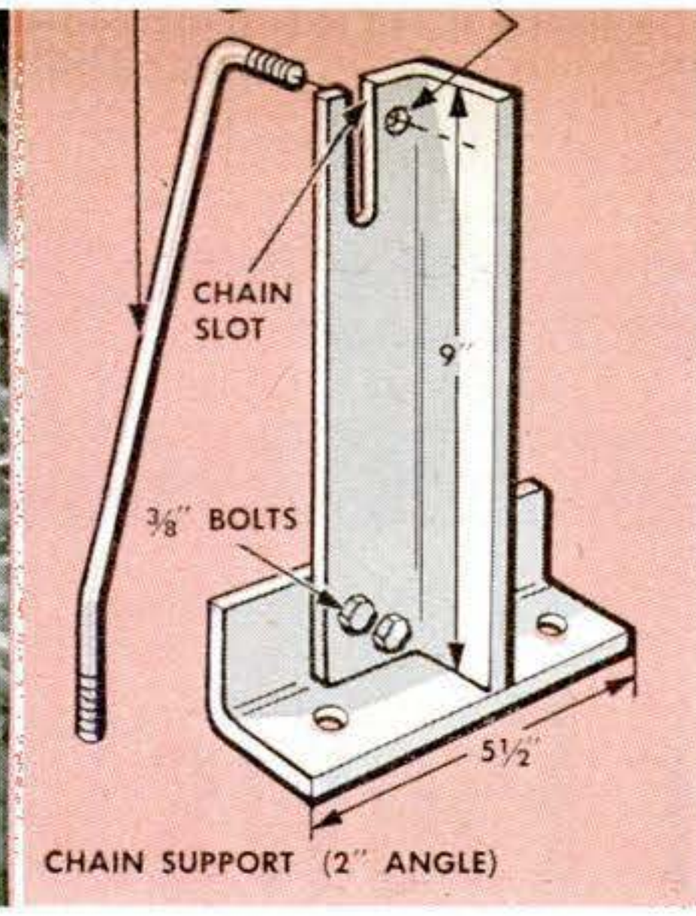

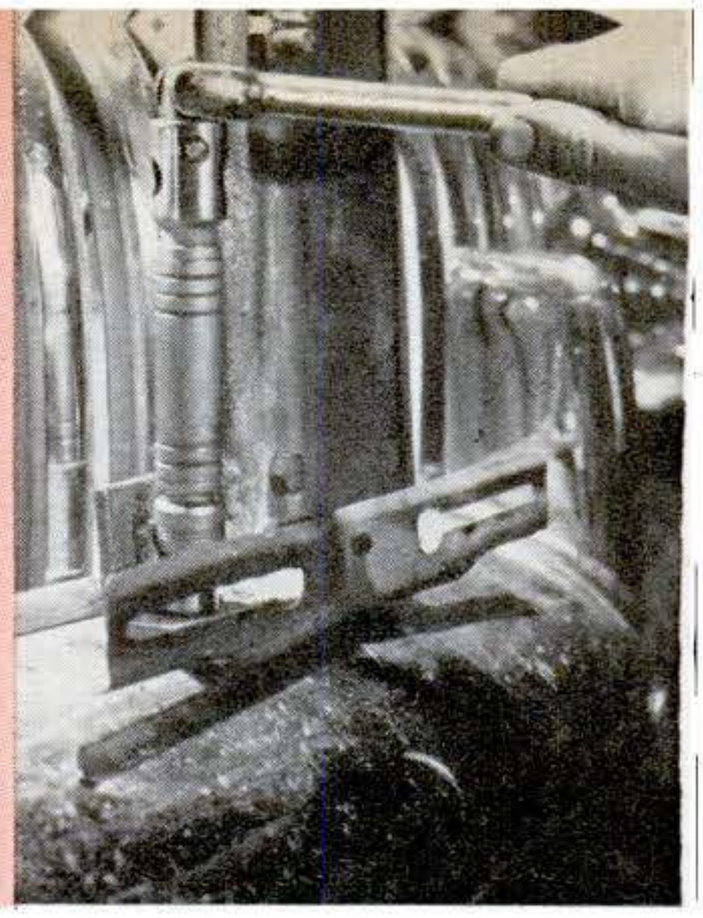

TWO A-SHAPED FRAMES are joined by a ½" bolt at apex of rear frame. Second bolt at point of front frame is lifted out of cross member and dropped into hole in either leg to set blade at an angle. Support chain hooks into angle-iron upright (above) mounted on bumper. Tension rod runs through gravel shield and channel where hitches are.

DRILL 5/16"
13" x 70"
11-GA. SHEET STEEL
STIFFENERS
(1" x 1" ANGLE)
3/16" x 2" x 70"
SCRAPER
13" RAD.
50"
90° ELBOW
CHECK CHAIN
2" PIPE
45" LONG
U BOLT
(3/8" ROD)
14½" RAD.
CUT NOTCH,
BEND AND WELD
1½" PIPE
24" LONG
6⅝"
GRIND
CLEARANCE
2½"
45° ELBOW
½" BOLT
PIVOT PLATES
(3½" ANGLE)

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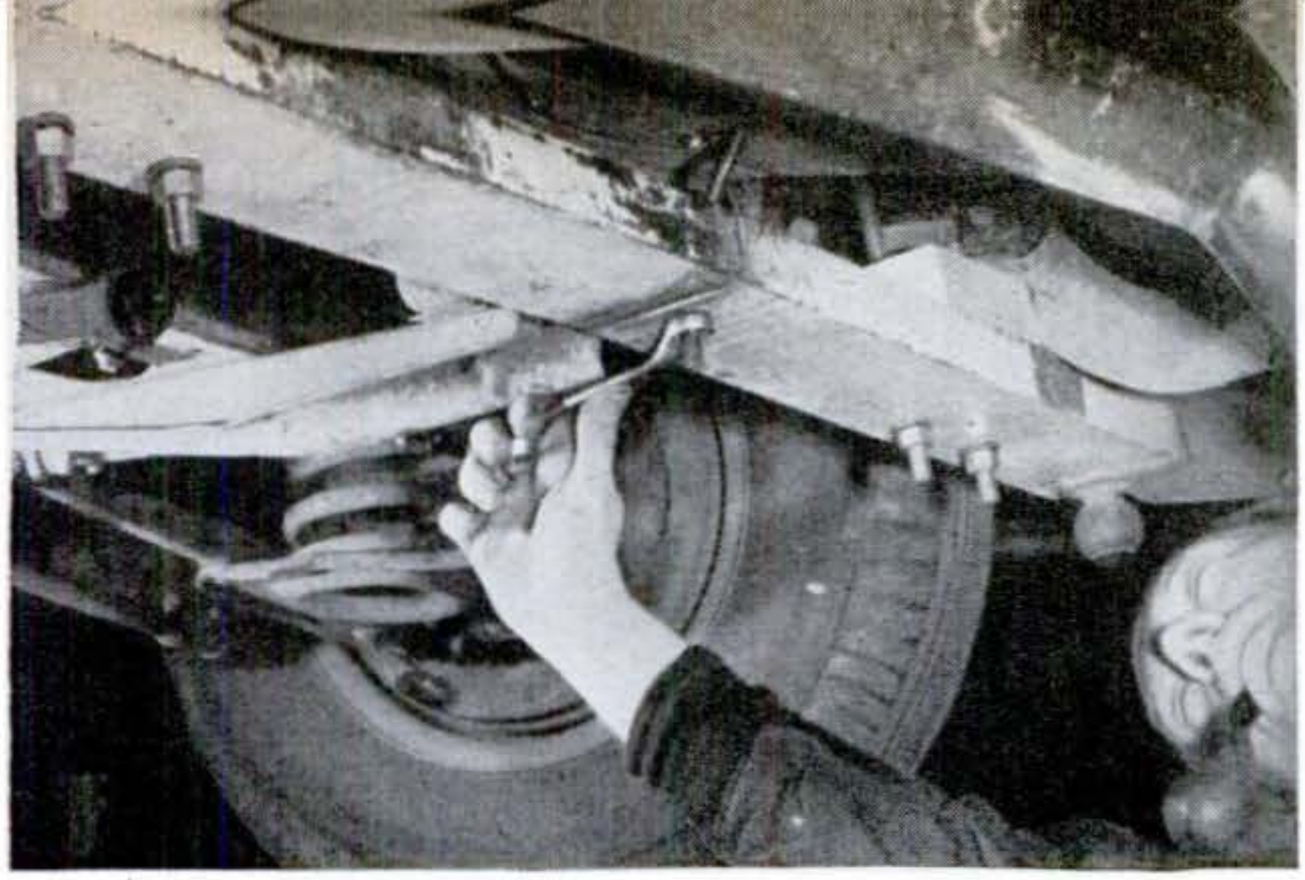
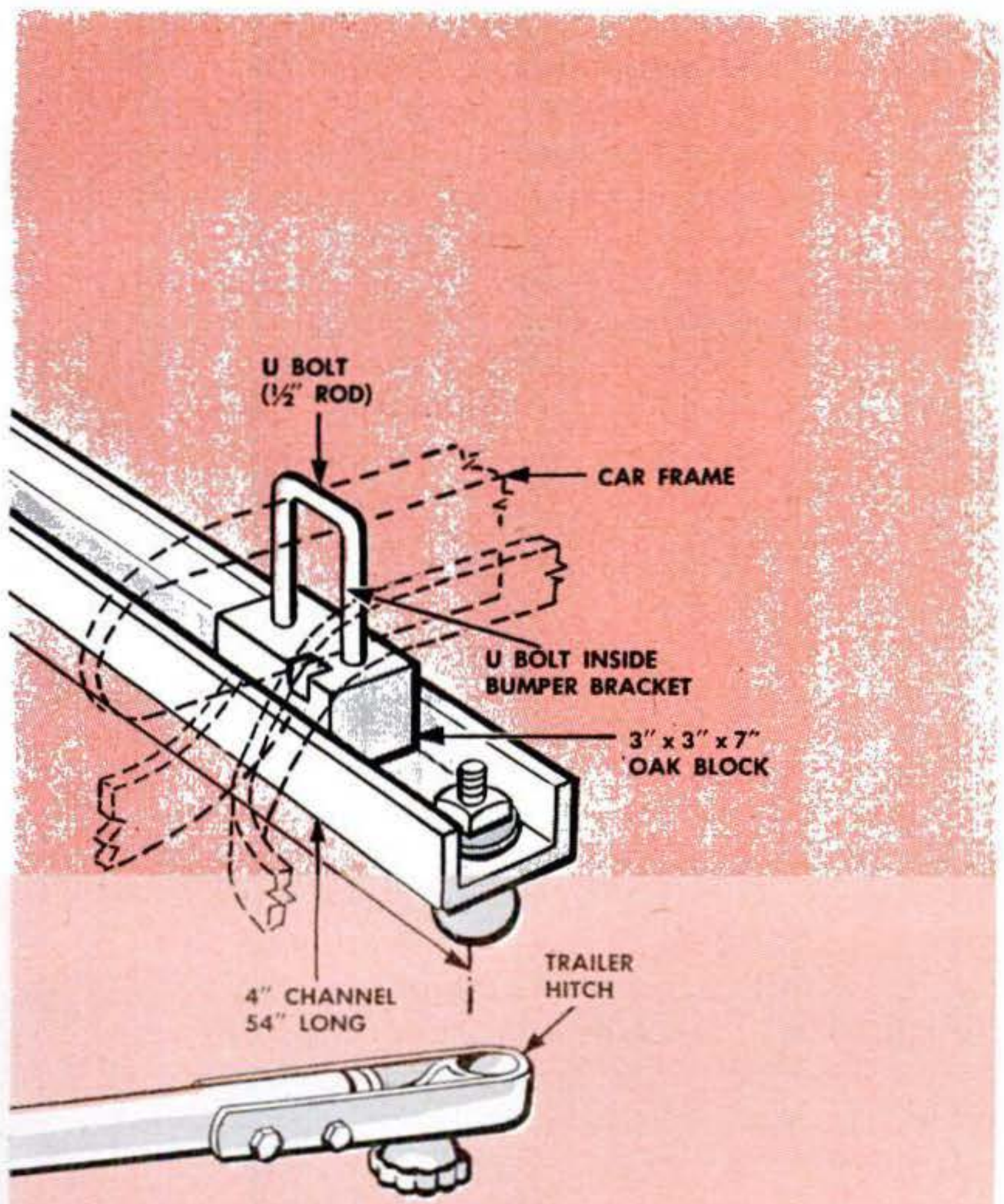
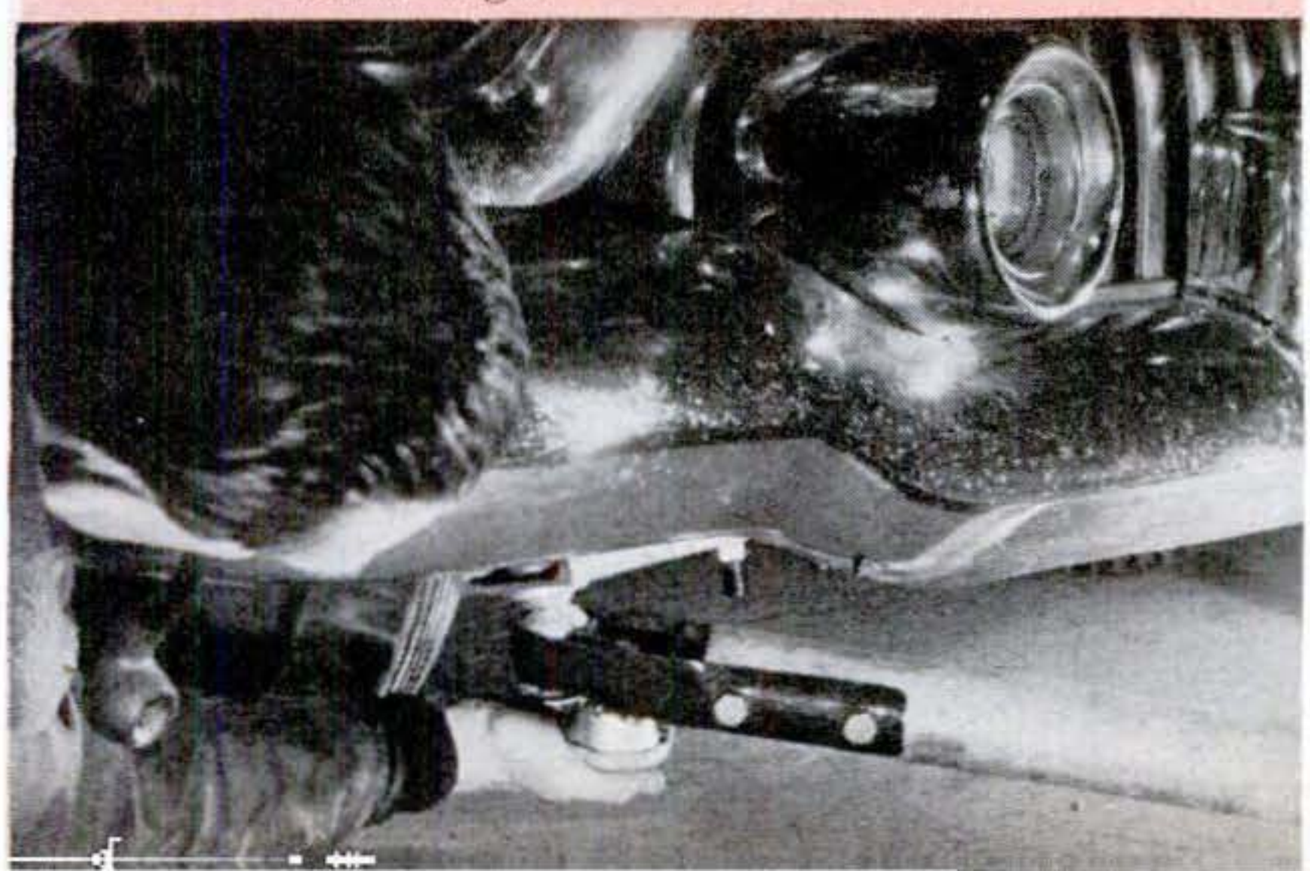


HITCH BALLS are mounted on channel held by U bolts. Snugged between frame and bumper brace, they can't slide under bulldozing load. Above, tension-rod nut is tightened.



TRAILER HITCHES make it easy to couple up the plow. To disconnect it, one need only loosen the hitch clamps and jump on the frame legs.



WHAT THE MATERIALS COST

Like many gadgeteers, E. F. Lindsley cut the cost of the job by buying secondhand stock from a junk yard. Here's his breakdown:

No. Pcs.	Size	Rear Frame	Price
1	8′	2″ pipe (scrap)	$1.00
1	2′	2″ angle	.50
2		trailer hitches	5.00
1	54″	4″ channel (scrap)	1.00
		Front Frame	
2	23″	1½″ pipe (cut and threaded)	$1.00
2	45°	1½″ elbows	1.60
1	90°	1½″ elbow	.80
1	3′	2″ angle	.50
		Blade	
1	13″x70″	11-ga. sheet steel, formed	$2.40
1	12′	1″x1″ angle (stiffeners)	1.20
1	6′	3/16″x2″ flat steel (scraper)	1.00
1	1′	3½″x3½″ angle (pivot plates)	.25
2		manure-spreader springs	1.50
		Miscellaneous	
Bolts, self-locking nuts, washers; ¼″ soft-iron rivets			$1.75
5′ of ½″ drill rod for main U bolts, damaged:			.50
20″ of 7/16″ rod for tension rod, 12″ of ⅜″ rod for check-chain U bolts 18″ of 2″ angle (chain support):			.50
		Total	$20.50

you use it right. But before signing up to plow all the driveways in town, let's look at some inescapable facts.

The gear ratio, clutch, universal joints and other parts of a car aren't built to take the punishment a tractor can. That's why I didn't make a blade high enough to push three-foot drifts. It's also the reason I get out and clear the first few inches of snow the old-fashioned way. If you don't do that, brother, you may find yourself shoveling after it has piled up.

Plowing requires traction. I use V-bar chains and celebrate the first snowfall by tossing about 300 pounds of sand into the trunk to give the rear wheels a good bite. In snow country both sand and chains may come in handy any time.

Car springs are so soft they will let a plow dig in, chatter, and jump when the going is hard. To minimize this, I mounted the hitch balls as low as possible, spacing them downward from the frame by putting oak blocks between. This gets the car shov-

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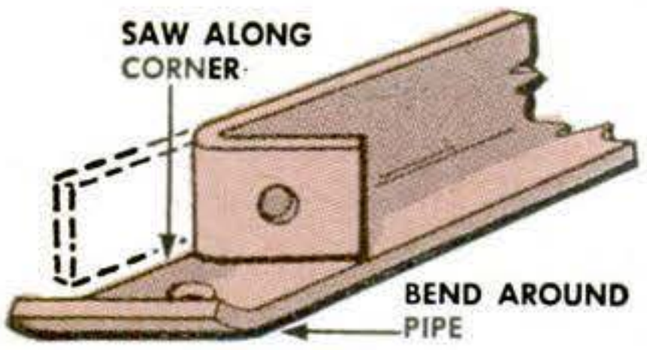
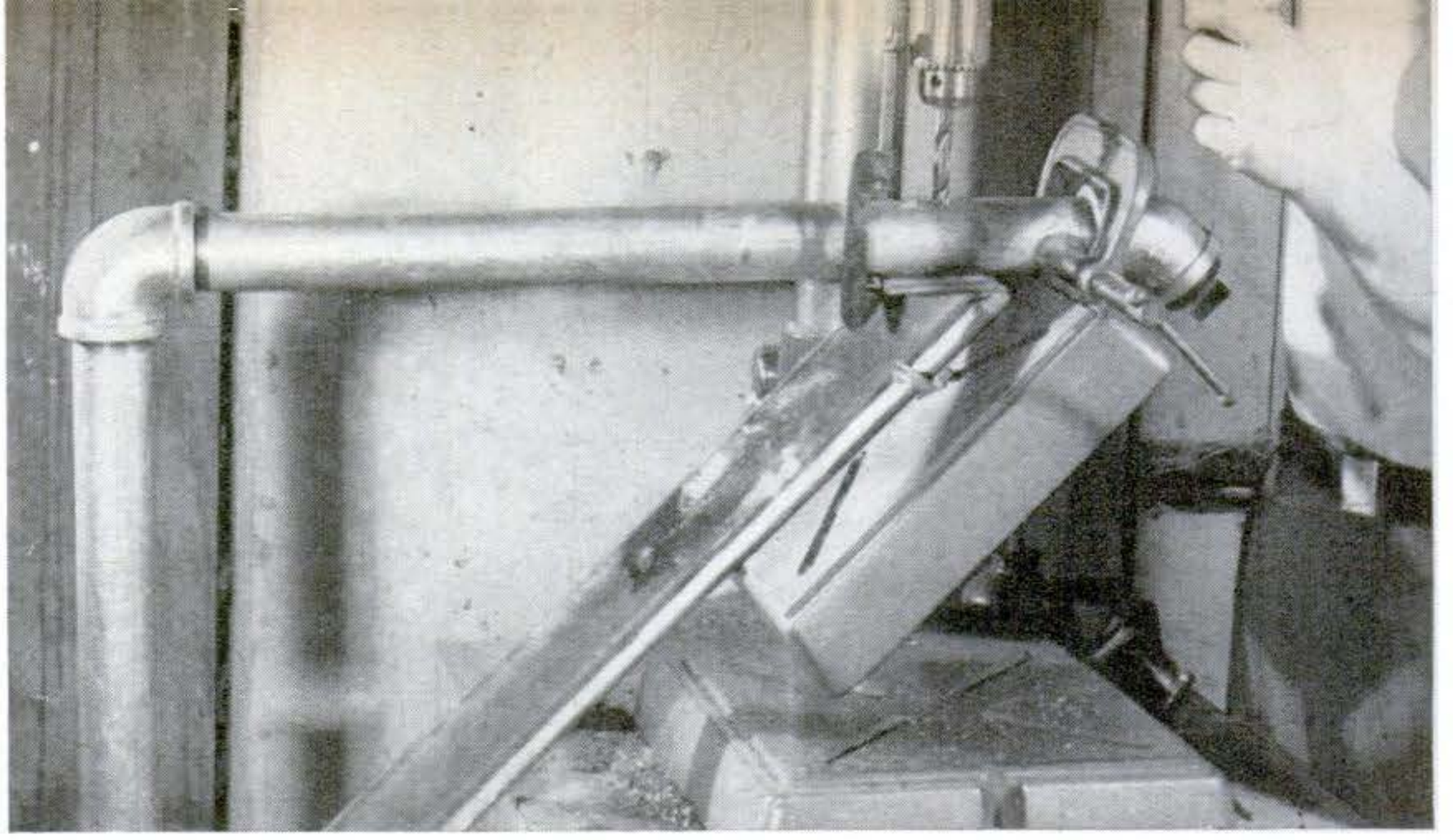


FRONT A FRAME is made of 1½″ pipe. Crosspiece of 2″ angle is sawed along corner, bent with aid of blowtorch, and clamped to pipe. Holes are drilled through both (right) for bolts at right angles.



ing behind the plow in a fairly direct line. Since the plow frame and blade are both free to pivot, the rig follows terrain fairly well without telegraphing every ripple back to the springs.

My plow was built for a 1952 Buick with synchromesh transmission. If your car has an automatic drive, remember that you may not realize it's overloaded until you smell hot oil. Use low range, of course, and if the going is very hard, do it in two or more installments.

BLADE CAN BE ANGLED to either side or set straight. Chain hooked into an upright on bumper controls height of blade, which can be held up for highway travel if necessary.

Choosing the materials. If some of the parts look heavy, remember you'll be ramming about two tons of car into a soft wall. Besides, you need a plow heavy enough to stay down at the bottom of the snow of its own weight. If it rides up, it won't do any work.

The trailer hitches I used cost more than homemade ones might, but I think they are worth the price. Both parts are permanently attached, with no loose bolts or nuts to lose in the snow or thread on with cold-numbed fingers.

You could use angle iron instead of pipe for the two frames if you're willing to weld, rivet or bolt all the joints. But pipe saves effort because it can be bought cut to size and threaded.

The curvature of the blade gives it extra backbone. Not caring to try to curve 11-gauge steel at home, I had the sheet-metal shop do it with a couple of kinks in the bending brake. So bent, my blade cost me $2.40. A sturdy plank, faced with galvanized iron, might make a fair substitute.

Building the rig. A couple of pipe wrenches will make assembly easier, and a blowtorch is handy for heating the necessary bends. The threads can be cut on the U bolts with a dime-store die (before the rod is bent, of course). Self-locking nuts are worth their extra cost so that you'll never have to fumble in the snow for loose ones.

Study the pictures and drawing carefully before grabbing your hacksaw. The plow mounting or the size and proportions of the frames may have to be changed to suit your car. Be especially careful that the hitch support under the car will not interfere with any of the working parts or bottom on the bumps.

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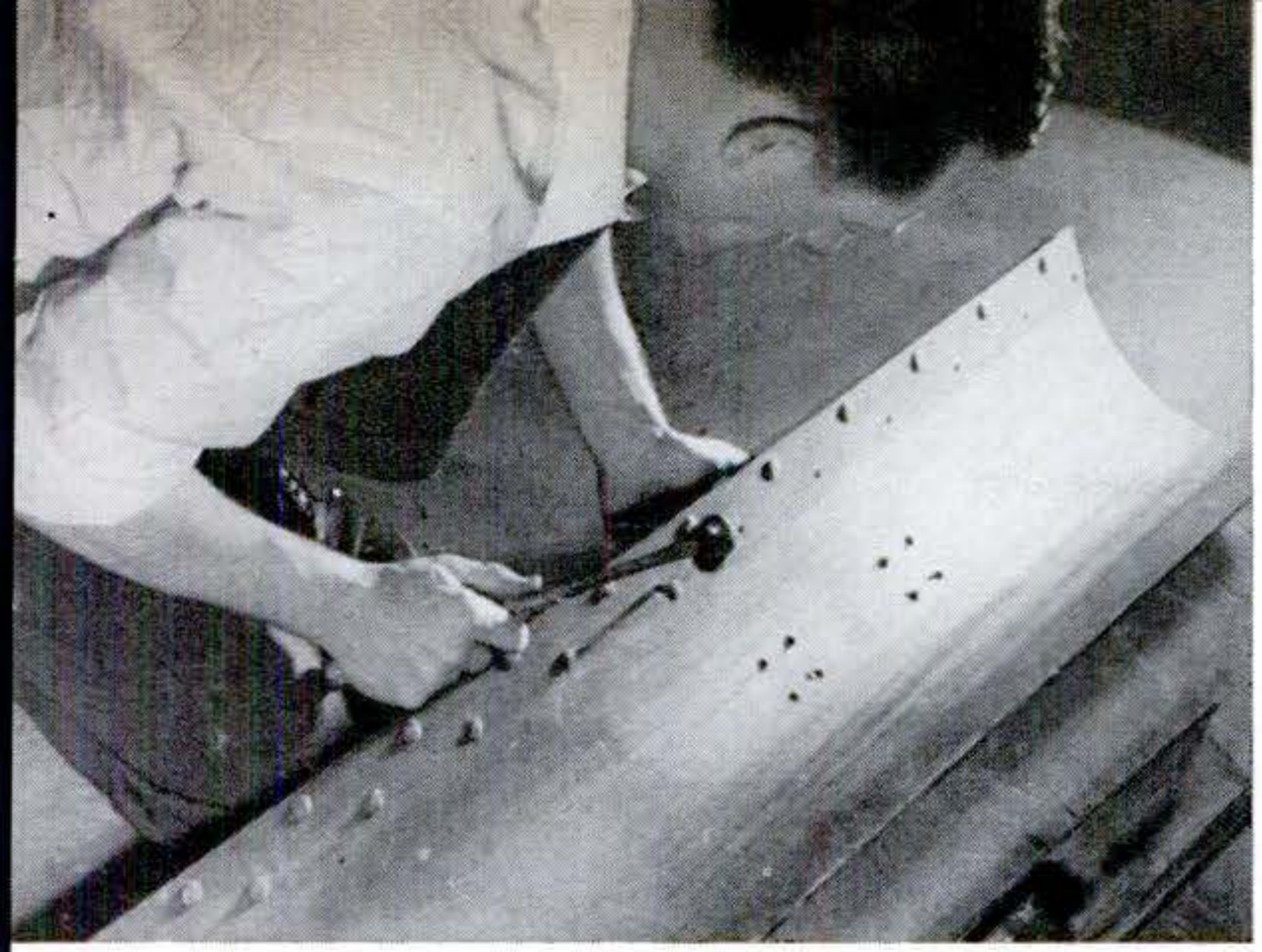
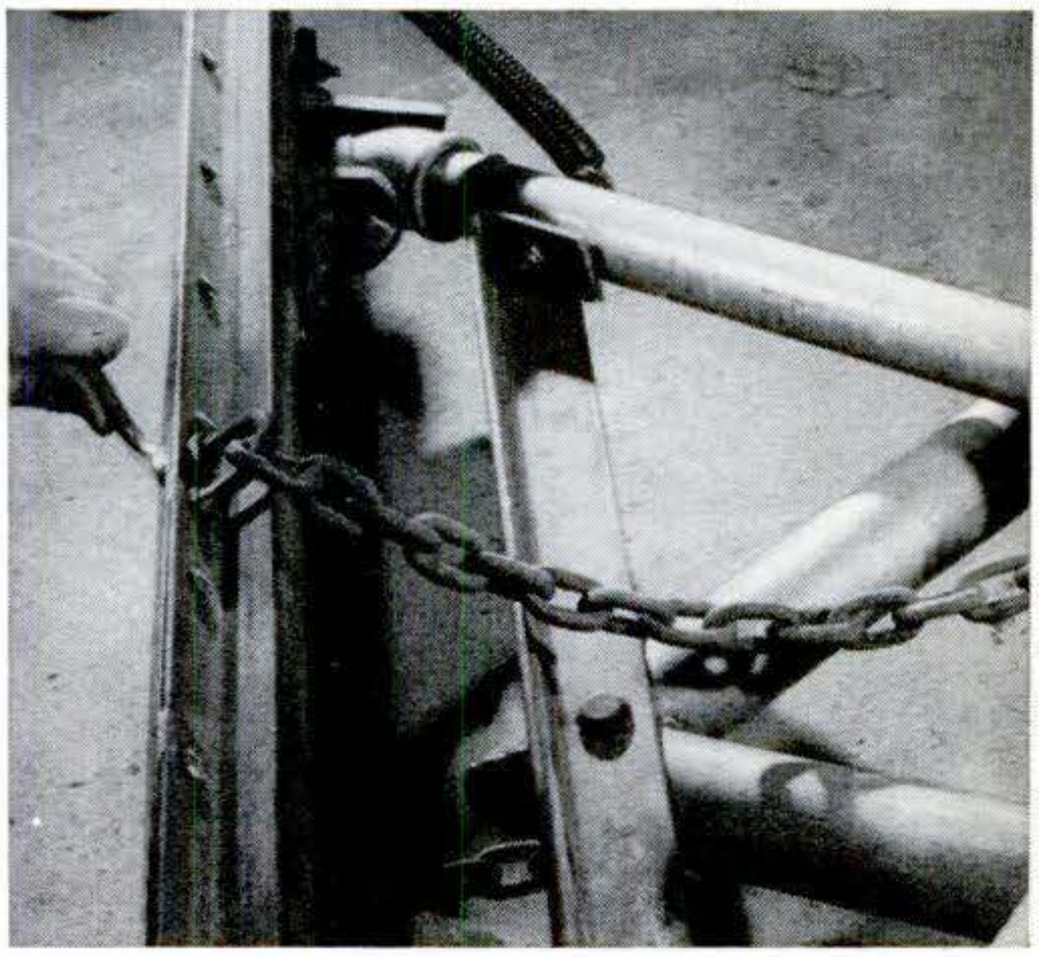


BUTTON UP lower edge of blade, scraper and stiffener with two rows of buttonhead rivets. Make holes snug and head rivets well over. Eight holes are for pivot-plate bolts.

BLADE PIVOTS on ½″ bolts through 45° elbows at ends of front frame. Pivot plates are sawed from 3½″ angle. Inside ones are cut short to clear elbow bend. Springs are clamped under bolts securing cross member. Other ends hook into holes in top blade stiffener.



CHECK CHAIN limits downward pivoting of blade. U bolt made of ⅜″ rod and mounted in upper stiffener will strip out if blade hangs up on obstacle. A second shorter chain from bottom of blade holds it against spring pull.

Blade construction. The 11-gauge blade is shod with a 3/16″-thick, 2″-wide steel scraper strip along the bottom edge. Stiffener strips of 1″ angle are mounted behind the blade both top and bottom.

Use soft-iron rivets, drilling the holes for a snug fit. Head every rivet over conscientiously. Cold weather contracts metal, and sloppy joints loosen up in rough going.

It's important to pivot the blade so that it can flop forward and snap free if it stubs its toe on ice hummocks, stones, or a cracked pavement. Manure-spreader springs, costing 75 cents each, maintain blade tension while permitting this action. By drilling several holes along the upper blade stiffener, you can hook the springs into whichever holes provide the best tension.

A check chain at the top limits blade flop-over. A second check chain hooked to the bottom edge limits the degree to which the springs can pull the blade up. Both check chains are attached to small U bolts. Made of ⅜″ rod, these are meant to strip out under extreme load.

Why not a V plow? Maybe you're wondering why I used a grader blade instead of a V type. The V blade looked good to me until I talked to some highway-maintenance men. They soon convinced me otherwise. A V plow, I learned, is fine the first time through. But when you try to widen that first pass, the plow is working on one of its angled sides only, and snow resistance tends to push it away sideways, sliding the car with it. For the same reason, a V plow will snake around in drifts, dragging the car with it.

If the end of the V slides into a snow bank, I was told, it may hook itself in so hard it cannot be backed out. But worst of all, a V plow necessarily throws up a ridge of snow along both sides. Because I have a curb of rocks set in concrete along my drive, each plowing would pile up a wider ridge and force me to plow farther away.

With the grader blade, I can plow right up alongside a wall or building in a series of small bites and shove the snow out ahead of me. Set at an angle, my plow can spill snow to either side. It can widen a channel by scraping a few inches at a time from the edges. Frozen rocks and ice hummocks will force a V plow to slide aside. Pivoted and spring loaded as my blade is, it swings back when it hits a snag, then rides over it and snaps back to work. END

Next Month: E. F. Lindsley will tell how to make a wheel sander to give you traction when and where you need it most.

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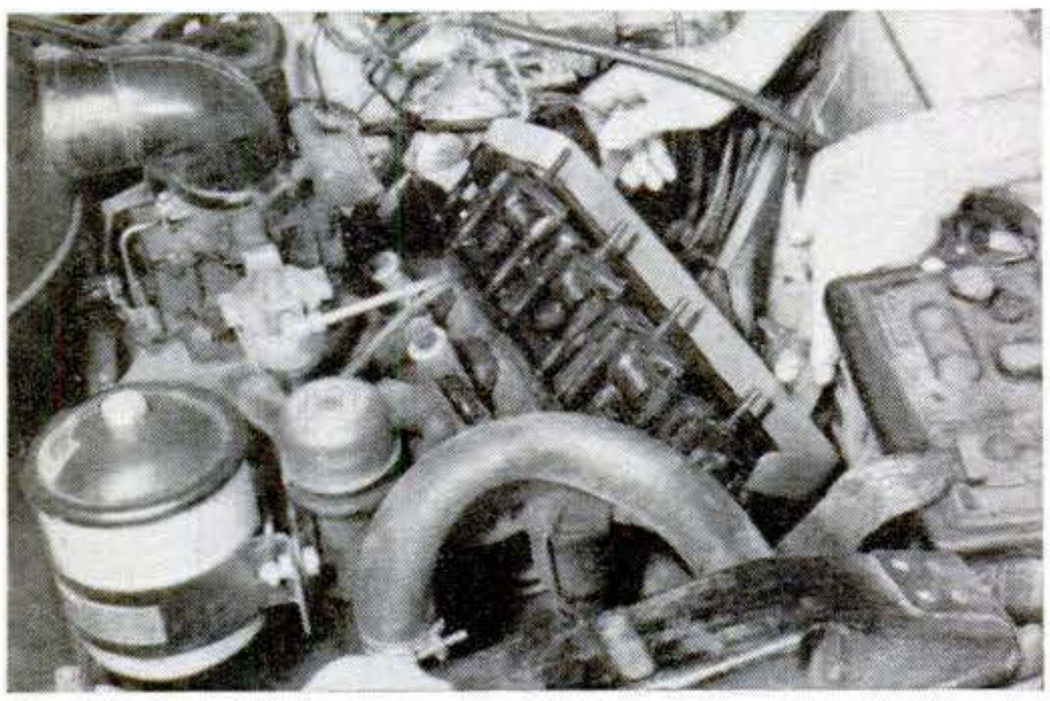
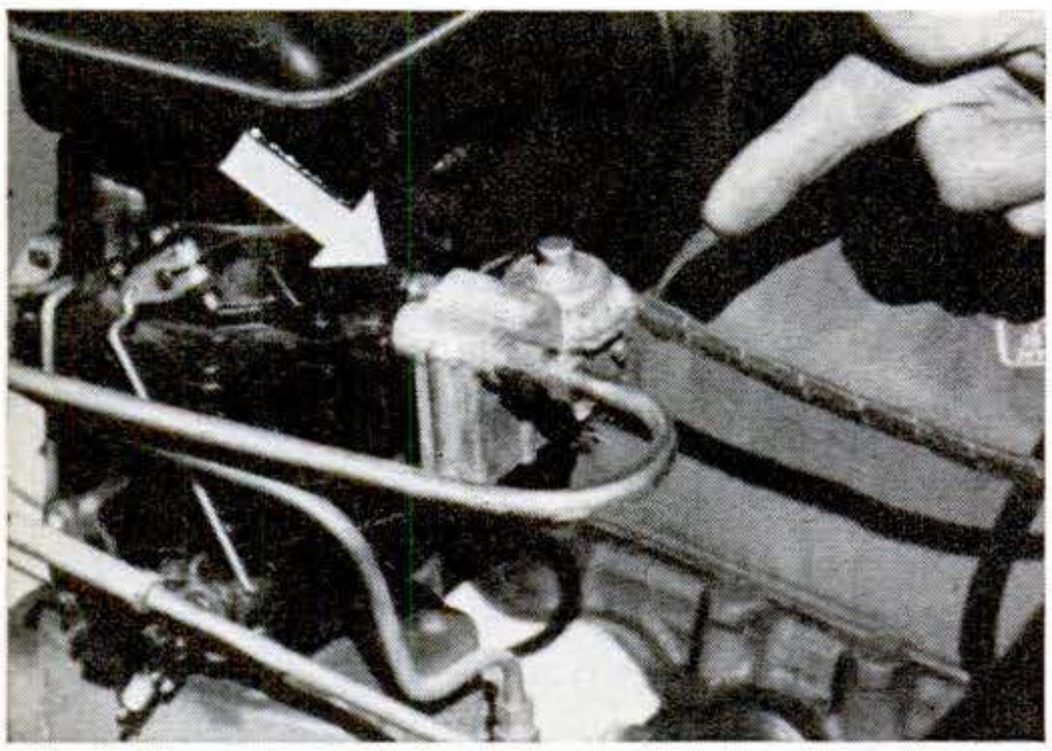
News
FROM AUTO ROW



1. Guards Stop Oil Shower. You won't get oil all over the place while adjusting V-8 overhead valves with these guards in place. The metal shields slip down over the valve-cover studs and have neoprene-rubber gaskets that keep oil from running onto the manifold, plugs and wiring. Besides saving a messy cleanup job, the guards prevent loss of oil usually wasted during servicing.



2. Control Smooths Fuel Flow. Carburetor flooding is avoided by this fuel-flow control. Connected in the line ahead of the carb, it is said to keep the flow constant, eliminating excessive and varying pump pressures that cause flooding, fuel waste, hard starting and engine wear.

3. Horse Is Vacuum Gauge. Pour on too much gas and the animated Dobbin on the dash will collapse, warning you of costly fuel waste. A vacuum gauge in the form of a toy horse, it stands upright when manifold vacuum is high, wobbles and droops when vacuum drops. Attached to the vacuum line, it's also said to warn of burned or sticky valves, bad timing, compression leaks and other engine ailments.

4. Fluid Seals Tire Tubes. Ordinary tubes can be made self-sealing with a new liquid latex, the maker claims. A tube of the fluid is simply screwed onto the valve and squeezed, coating the inside of the tube.

5. Plug Has Three Outer Electrodes. This spark plug has three chances to fire properly. When one outer electrode burns away, the spark jumps between the center and the closest of the two remaining outer electrodes, keeping the gap correct. The plug also has an airplane-type aluminum oxide insulator and comes pregapped for each car.

6. Light Warns Truckers. If the marker lights on a big truck or bus go out, this circuit detector automatically switches on an emergency floodlight to warn other vehicles. Two dash lights also tell the driver whether the trouble is in the circuit or the lamps.

Further information on these products can be obtained from: 1. Pierce Specialized Equipment Co., 350 Peninsular Ave., San Mateo, Calif.; 2. Schneider Carburetor Co., 6218 Clayton Ave., St. Louis 10; 3. Mehren Industries, 9909 Santa Monica Blvd., Beverly Hills, Calif.; 4. W. J. Smith Co., 420 Lexington Ave., NYC; 5 Luthy Aeronautical Sales Co., 302 Cooper St., Jackson, Mich.; 6. E. Edelman & Co., 2332 Logan Blvd., Chicago 47.

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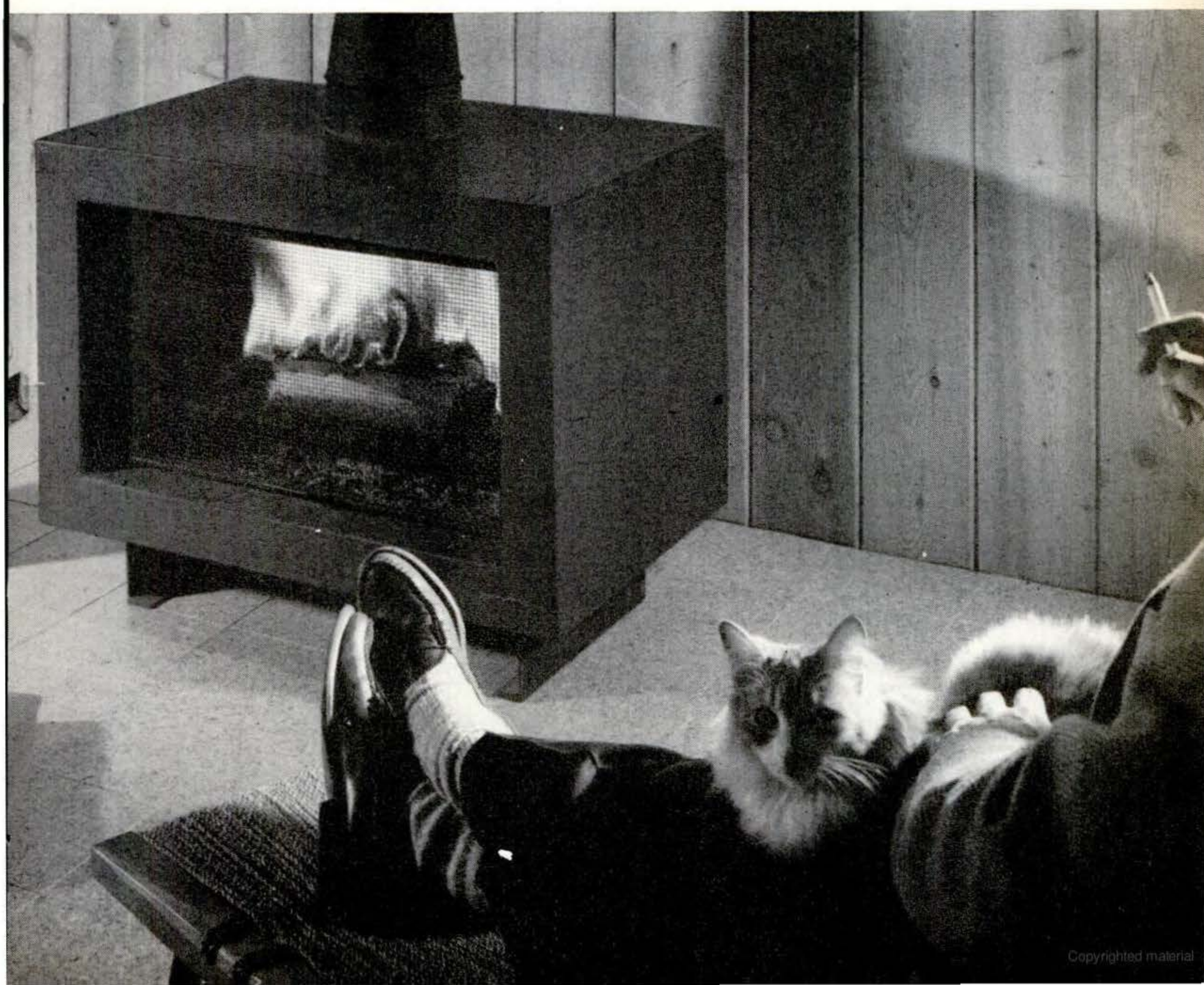
Fireplaces Anyone Can Install

Metal prefabs that come in a box, burn real logs and work like a stove make it easy to add a fireplace in a few hours.

By Jerry Parker

THE old-time wood stove that toasted Granddad's toes while he told tall tales by the firelight is coming back in style. Shiny, streamlined modern versions enable you to add a fireplace to a house without tearing out walls and spending hundreds of dollars on heavy masonry. You can buy one for $100, install it in a day.

Because the prefabs are actually classed as wood stoves under building-code regulations, hooking them up is easy. They're light enough to stand on the floor or hang on a wall without additional bracing. They connect to any 6″ or 8″ flue opening with



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SIX SHINY MODELS TO CHOOSE FROM

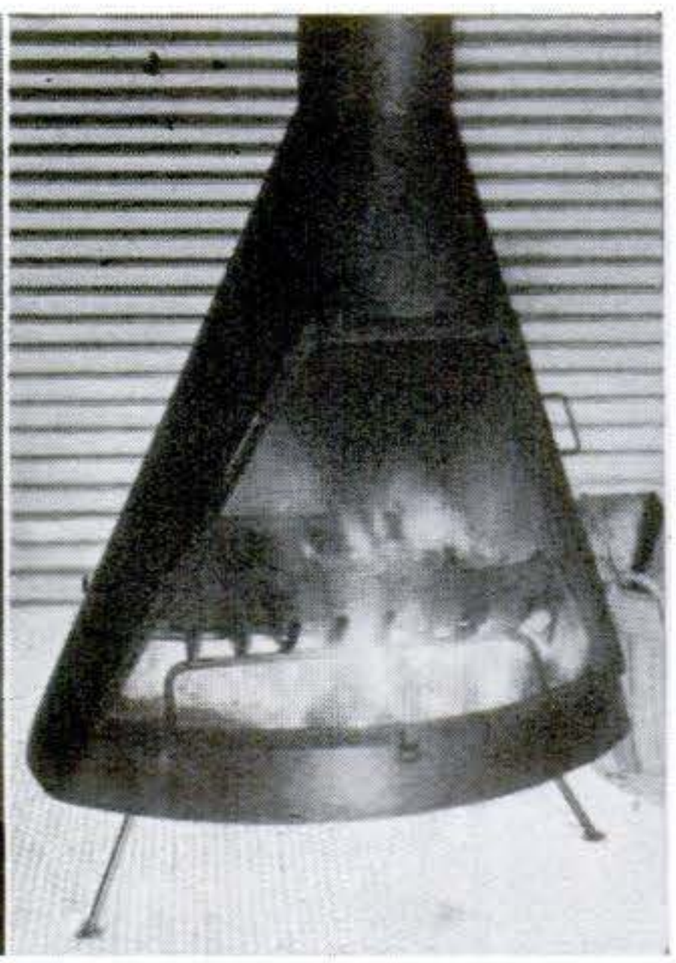
OLD-TIME FRANKLIN STOVE is still going strong in this slicked-up, modern version you can mail-order from Sears, Roebuck for under $40. Made of cast iron, it lasts forever, but has relatively small 13″-wide firebox.

PIONEER PREFAB is this porcelain-enamel model made by Acorn Houses, Concord, Mass. It sells for about $100, comes in red or gray stippled finish, has smooth, hard surface that's easy to clean. It can sit on floor or hang on wall.

MODERN POTBELLY is specially designed to blend well with exposed stovepipe where it would be too costly or difficult to hide flue in wall. Made by George Kosmak of San Francisco, it sells for about $150, comes with grate for fire.

INSULATED FIREPLACE, another Kosmak design, has glass fiber in back and bottom to reduce heat loss, permit placing it close to wall without damaging paint. One of biggest prefab units made, it is nearly a yard wide and a yard high.

DOUBLE-WALLED UNIT has hollow-core sides for insulation, vents for circulating heat. Made by Manchester-Pierce, Bellevue, Wash., it costs about $200, has flue opening on top so stovepipe can be run straight up to ceiling.



FANCY FIREPLACE is this giant made by Wally Reemelin of Berkeley, Calif. Costing about $300, it is 50″ high, 40″ wide, can burn 30″-long logs. It comes with removable tripod legs, andirons, screen, damper, flue, and roof collar.

ordinary stovepipe. Start in the morning and there's a good chance you'll have a fire by nightfall.

Which one to buy? Of the several makes now on the market, choice is largely a matter of price and style. All are welded steel. All work the same way.

They range from $100 to $200, with a real fancy job going at around $300. Some are swank, some rustic. Some are especially designed to blend well with a stovepipe when installed where the pipe must remain exposed. Some have the flue opening at the top instead of the rear, making it easy to run the pipe straight up to a ceiling or roof. The best bet is to figure out first just what flue mounting you need.

Setting it up. Since code requirements

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vary from one locality to another, it's wise to ask your building inspector for his advice before setting up your prefab. In some areas, such units must be set at least 18″ from a combustible wall. Putting up a shield may let you place it closer and should be done anyway to protect the wall from heat. Easiest way to do this is to nail up a sheet of asbestos board behind the fireplace. You can paint it to match the wall.

You'll also want some kind of simple hearth to catch occasional sparks. This can be a couple of loose slabs of slate, a piece of asbestos board, or a sheet of metal.

Installing a damper in the connection to the flue is not necessary in most installations, but is inexpensive to do and will always be there if you need it. A damper is a must if you plan to share a furnace flue so that the fireplace can be shut off when not in use.

What chimney to use? I was lucky enough to have an old flue that was used for an abandoned wood stove. All I needed was one short length of stovepipe to hook the new prefab to the old flue.

But if you don't happen to have a spare flue, you still have lots of choices. Perhaps you have an old kitchen-range flue that backs up to the living room. You can seal up the kitchen opening and break a hole through on the living-room side.

If you plan to use any existing flue, have it checked first to make sure it's clean and sound. Many old chimneys were built without flue linings, and cracks in the masonry could be dangerous.

You can share a flue. Tying into the regular furnace flue is not generally recommended, but may be another possibility if very carefully done. The chief danger is that it may rob the furnace of proper draft.

This should not be attempted on gas-furnace chimneys, which are usually not designed for high-temperature operation, and is not easily done on short one-story chimneys. On taller chimneys, you may be able to get away with it. It may also be possible to improve a chimney's draft by adding a spinner on top or increasing its height. Let your heating man tell you whether you can safely share your furnace flue and how to do it.

Let the stovepipe show. If your fireplace is to go directly under a roof, as in a

ONLY ASSEMBLY JOB is bolting legs on some models. Here legs are attached to bottom for floor mounting, could also be screwed to back for hanging on wall. Unused mounting holes are plugged with short bolts provided.

CONNECTION TO FLUE is made with ordinary stovepipe, available in straight, curved and other shapes for making various hookups. Here reducing section joins 8″ collar on fireplace, standard on most prefabs, to 6″ flue.

FINISHED FIREPLACE is as cheery and warming as any you'd want, burns logs as big as most average-size conventional ones. Hearth is made of cemented bricks, but is more for looks than need. Firebricks make andirons.

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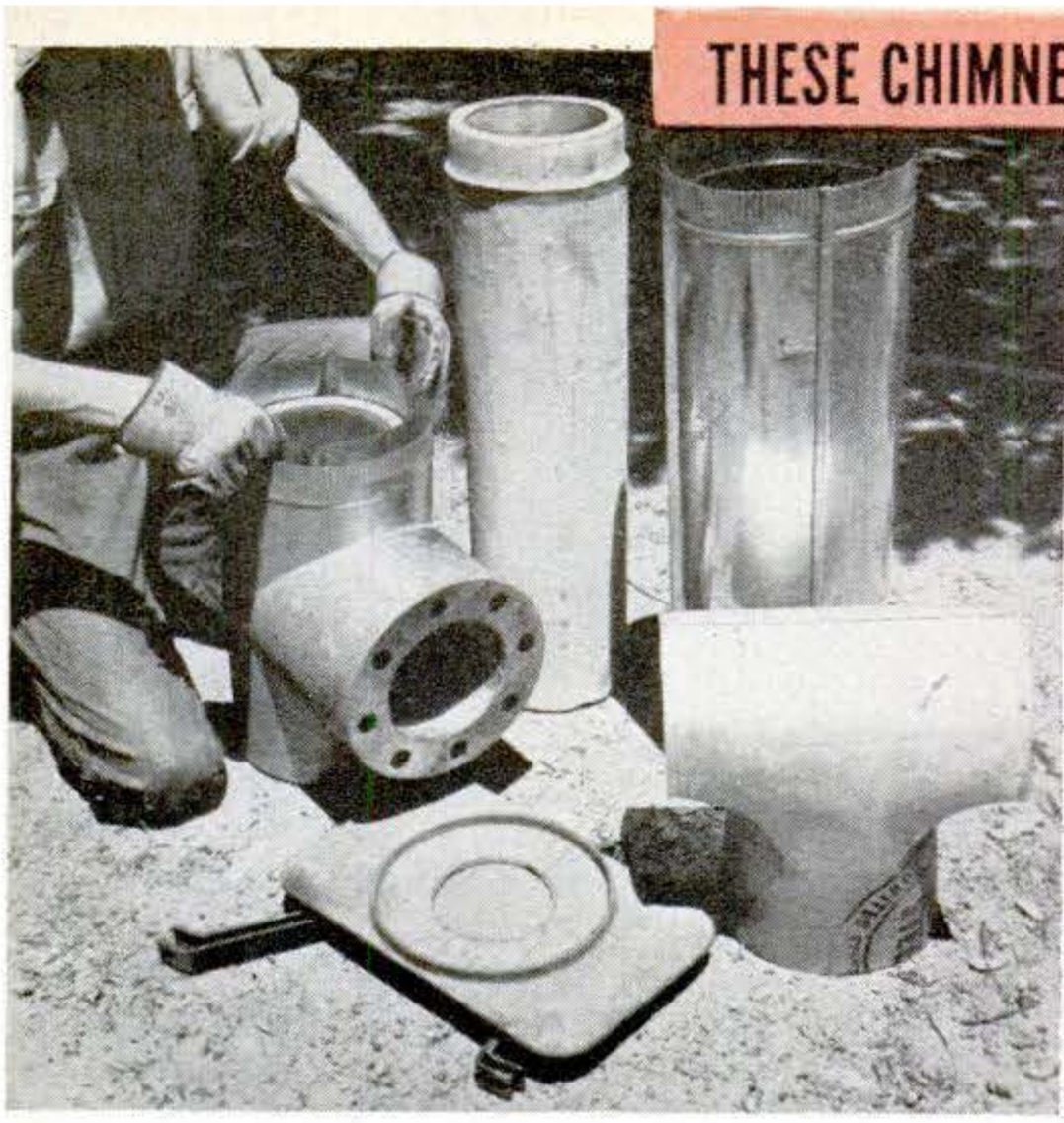
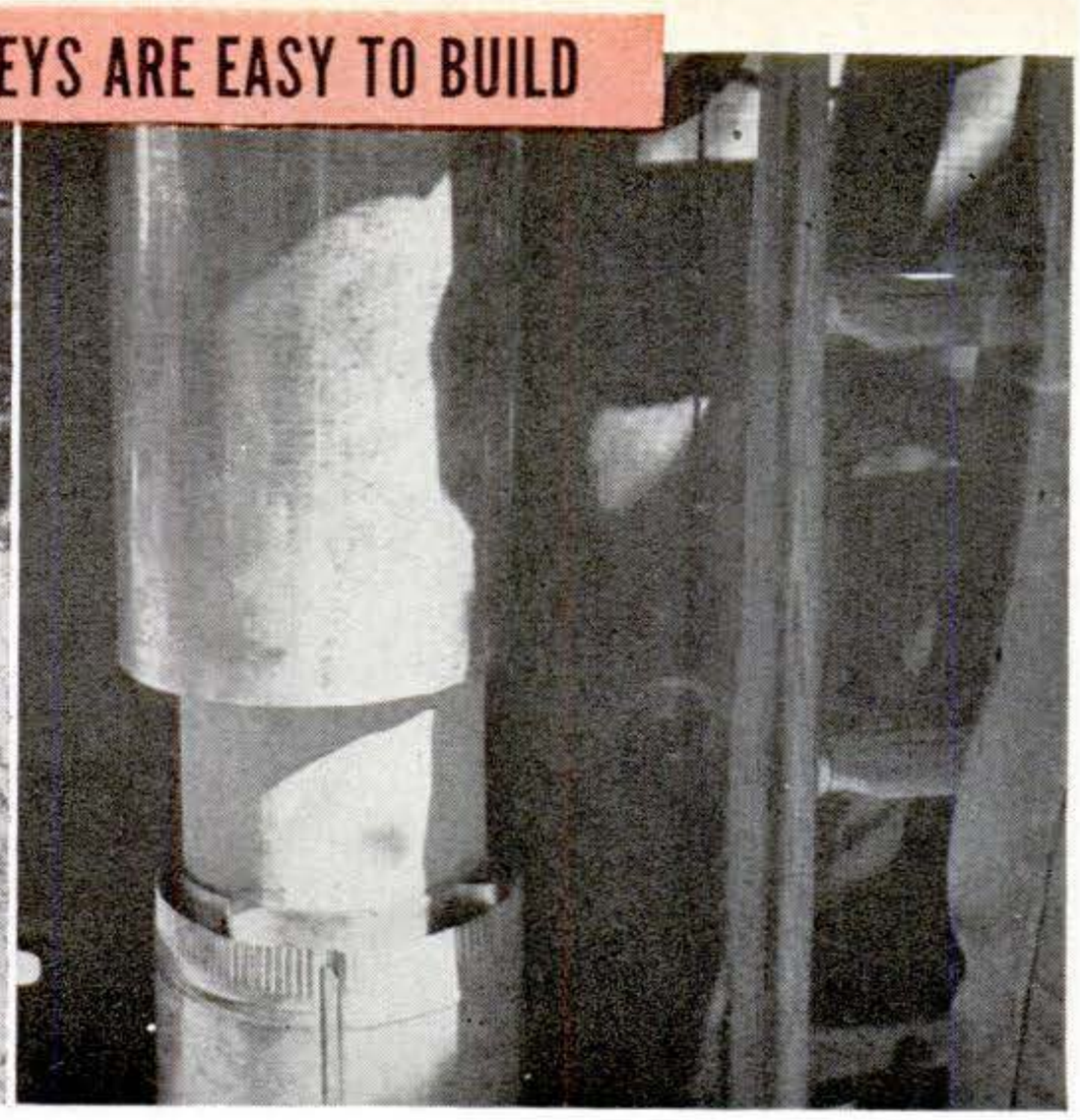
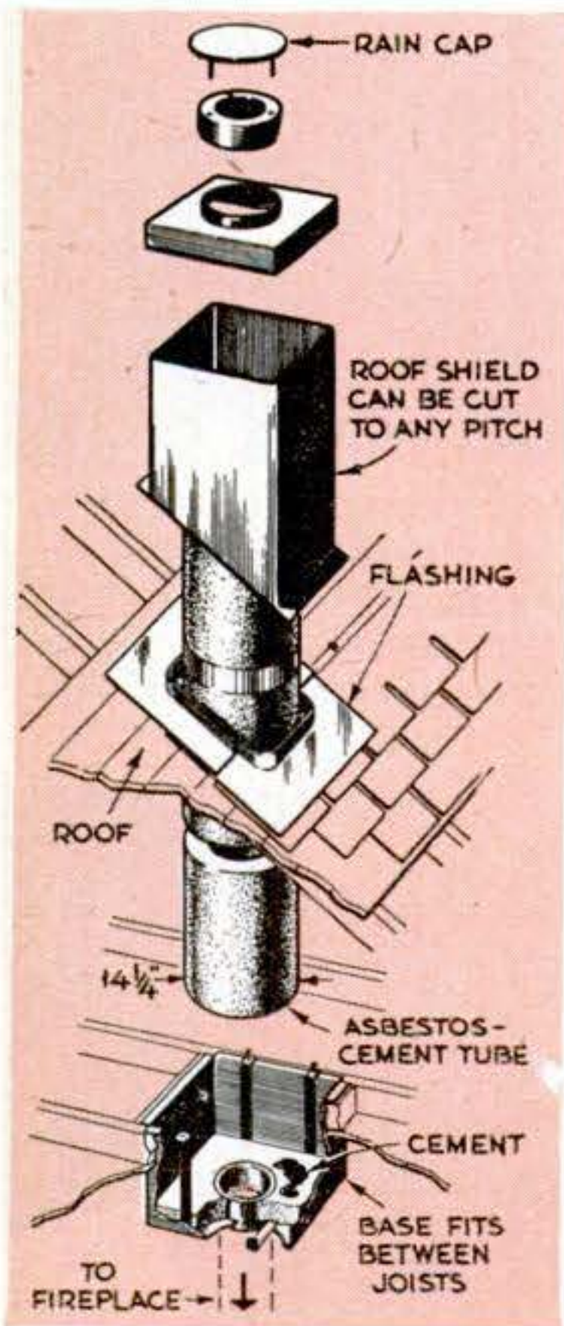
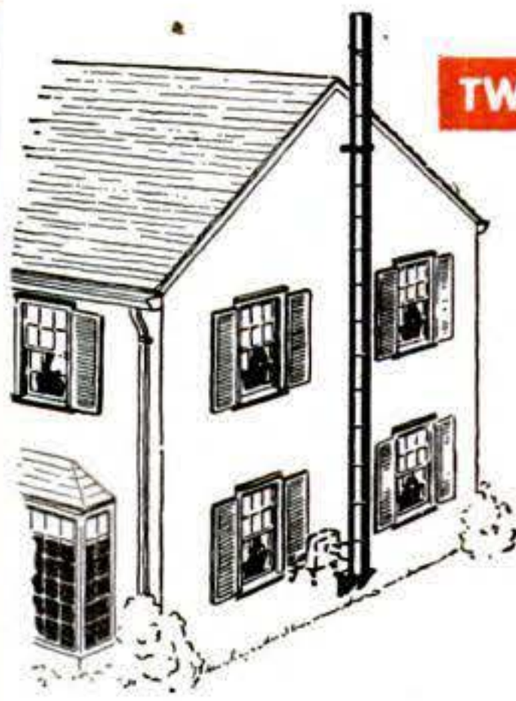
THESE CHIMNEYS ARE EASY TO BUILD





PREFAB CHIMNEY makes economical hookup where there is no existing flue. It consists of clay tiles in metal shield with air space between for insulation. Parts can be bought through local heating contractors. Tiles are simply cemented together length by length and metal shield slipped on top (right). Chimney is self-supporting, needs no fastening to house except at top and bottom, and can be run either inside or outside.





THREE ARRANGEMENTS OF PREFAB CHIMNEYS are shown above. In two-story house (left), it's usually easier to put chimney outside. Base rests on wall bracket, and tee fitting leads flue into house. In one-story house (center), chimney is run through roof and base supported on joists. Stovepipe is then run from ceiling down to fireplace. Same method can be used for upstairs fireplace in two-story house. If fireplace goes directly under roof (right), stovepipe can be run straight up to roof, then topped off by short chimney.

SECTIONAL CHIMNEY (left), another type of prefab, consists of asbestos-cement tubes cemented together like clay tiles but without metal shield. Made by Van-Packer Corp. of Chicago, it comes with base that fits on joists and roof cap that looks like real chimney.

studio living room, unceilinged attic, or one-story cabin, you can dispense with a flue and run the stovepipe right up to the roof. If it happens to back up to a garage or utility room, you can run the pipe through the wall and then up to the roof.

In some localities, it may even be possible to run the stovepipe right out through the roof, eliminating the chimney completely. A heating expert will wise you up on code requirements and the parts to use.

Build your own chimney. If you're still stuck without a stack, you can put up your own prefab chimney to go with your prefab fireplace. This consists of clay pipes in a metal shield that are simply cemented together. A 20′ chimney costs about $100 and can be put up in a day. You can even get a squared-off roof cap that looks like a real chimney. END

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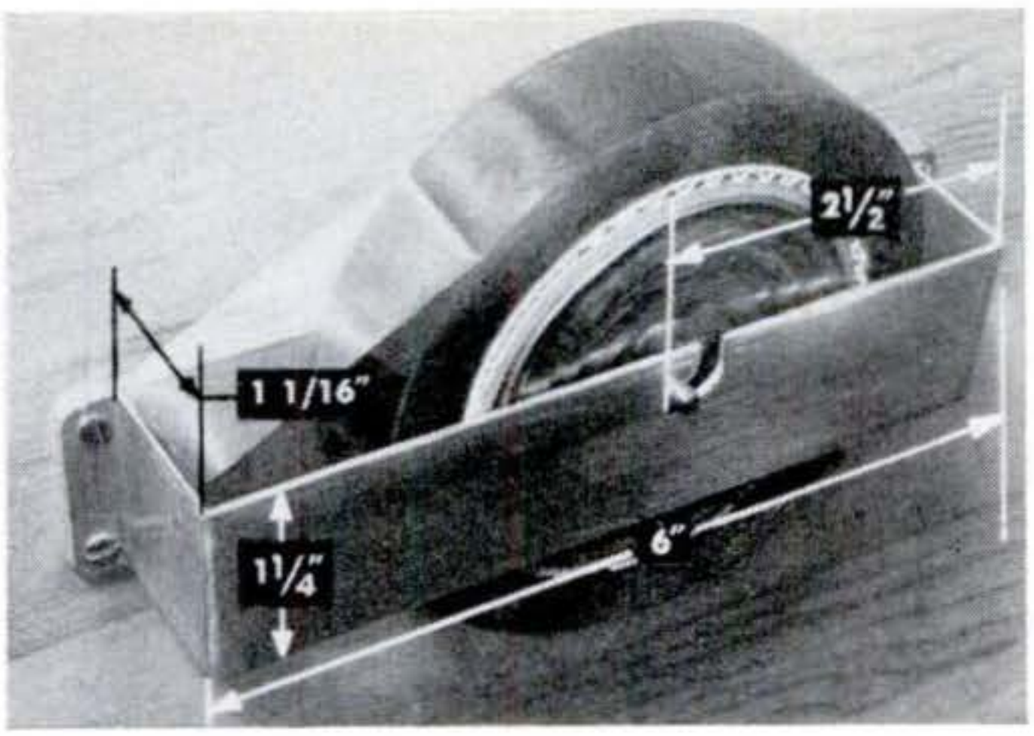


Scrap Makes Tape Dispenser

You can make this tape dispenser from a tin can and some scrap sheet metal. Screwed to a wall or side of a cabinet, it keeps your tape out of the way, yet handy.

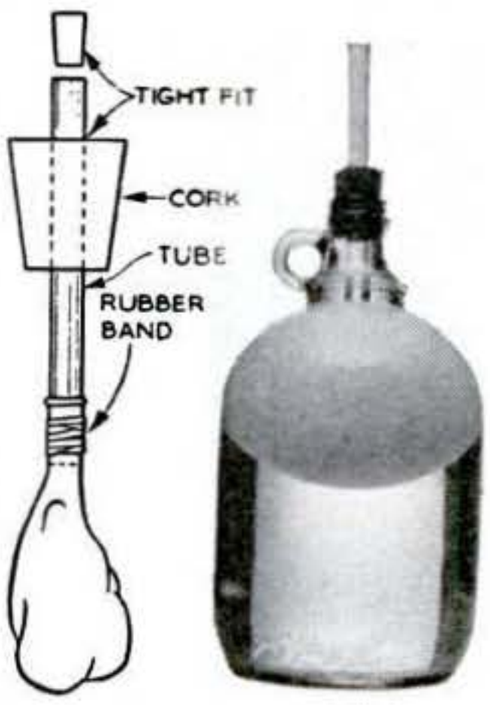
The frame should be two pieces of fairly stiff sheet metal—3/32" aluminum, for example—cut and bent as shown. A sharp, toothed edge is filed on the cutting lip. A tin can slightly smaller than the inner diameter of the tape roll is cut down for the hub. Its lid is soldered back on and a short brass rod soldered in for an axle.—*Will Thomas, Buffalo.*

Lens Clips on Drafting Pencil

FOCUSED on the pencil point, this magnifier will follow it wherever it goes. The lens is set in half of a spectacle frame that is soldered to a slot filed in the ball tip of a pocket pencil clip. It swings up when not in use.—*A. L. Specker, Freeport, N. Y.*

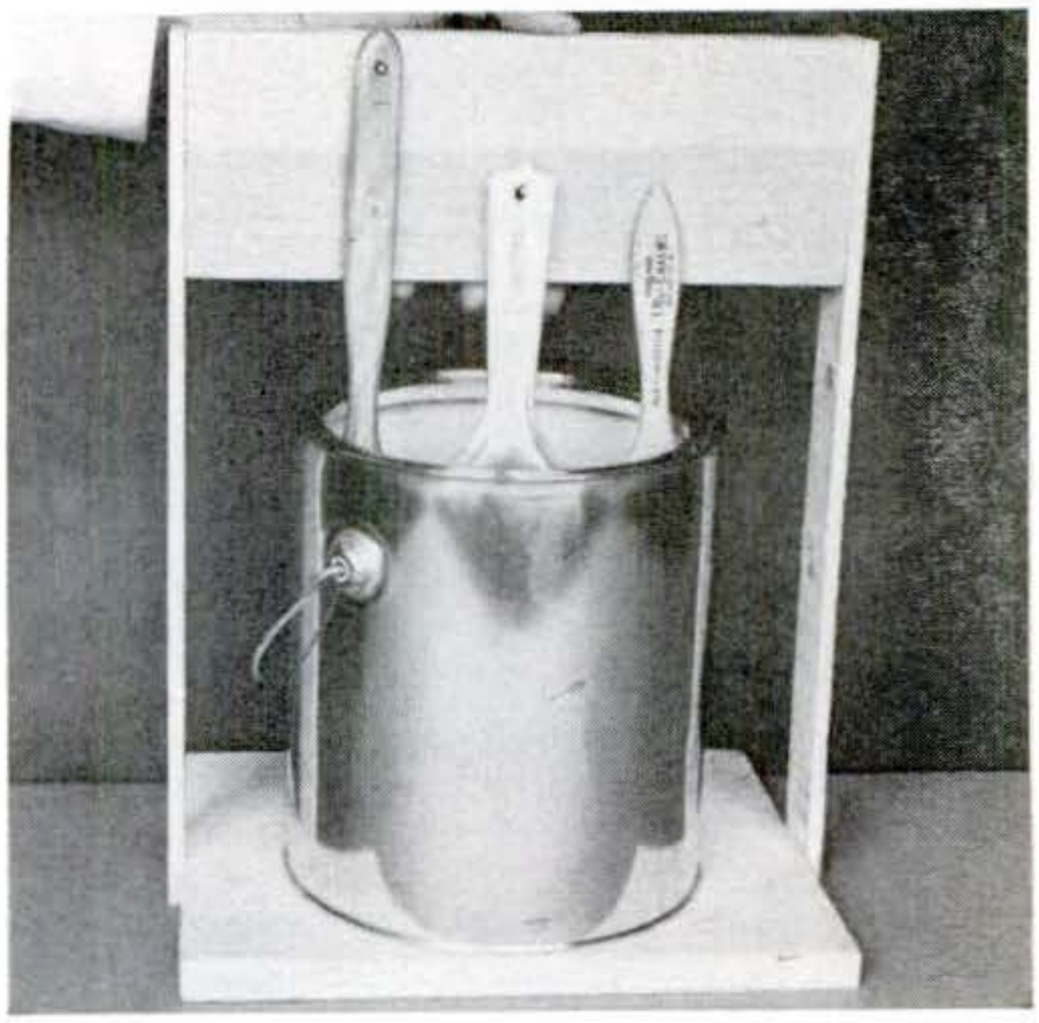
Balloon Seals Photo Chemicals

NO MATTER how tightly corked, partly used photo chemicals spoil in storage because they oxidize in the air trapped in the bottle. A balloon blown up inside the bottle drives out the air and seals the chemical.—*R. J. Decker, Brooklyn, N. Y.*



Brick Base Stops Vermin

TERMITES and vermin are less likely to make a home in your woodpile if you provide a circulating air space under the logs. An easy way to do this is to stack the wood on a base made of bricks laid on edge. I found that three rows of bricks, laid with space between the ends, do the job nicely. —*E. John Long, Bethesda, Md.*



Holder Keeps Brushes in Solvent

A SIMPLE holder like the one above will suspend several brushes in solvent. The can sits on the scrap-board base, while the brushes are hung from nails—driven at appropriate heights—in the 4"-wide cross-piece.—*O. A. Nelson, Seattle, Wash.*

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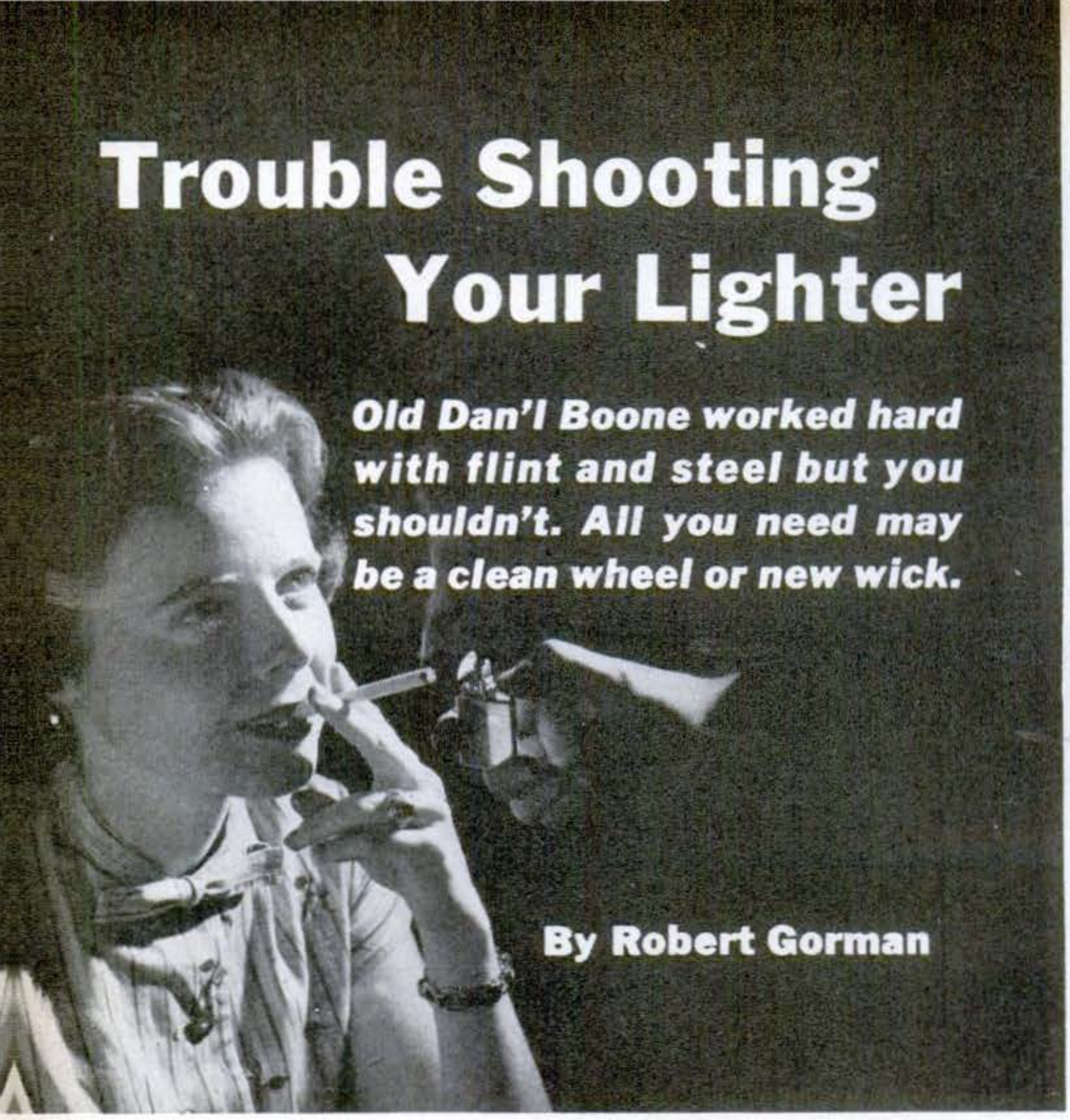
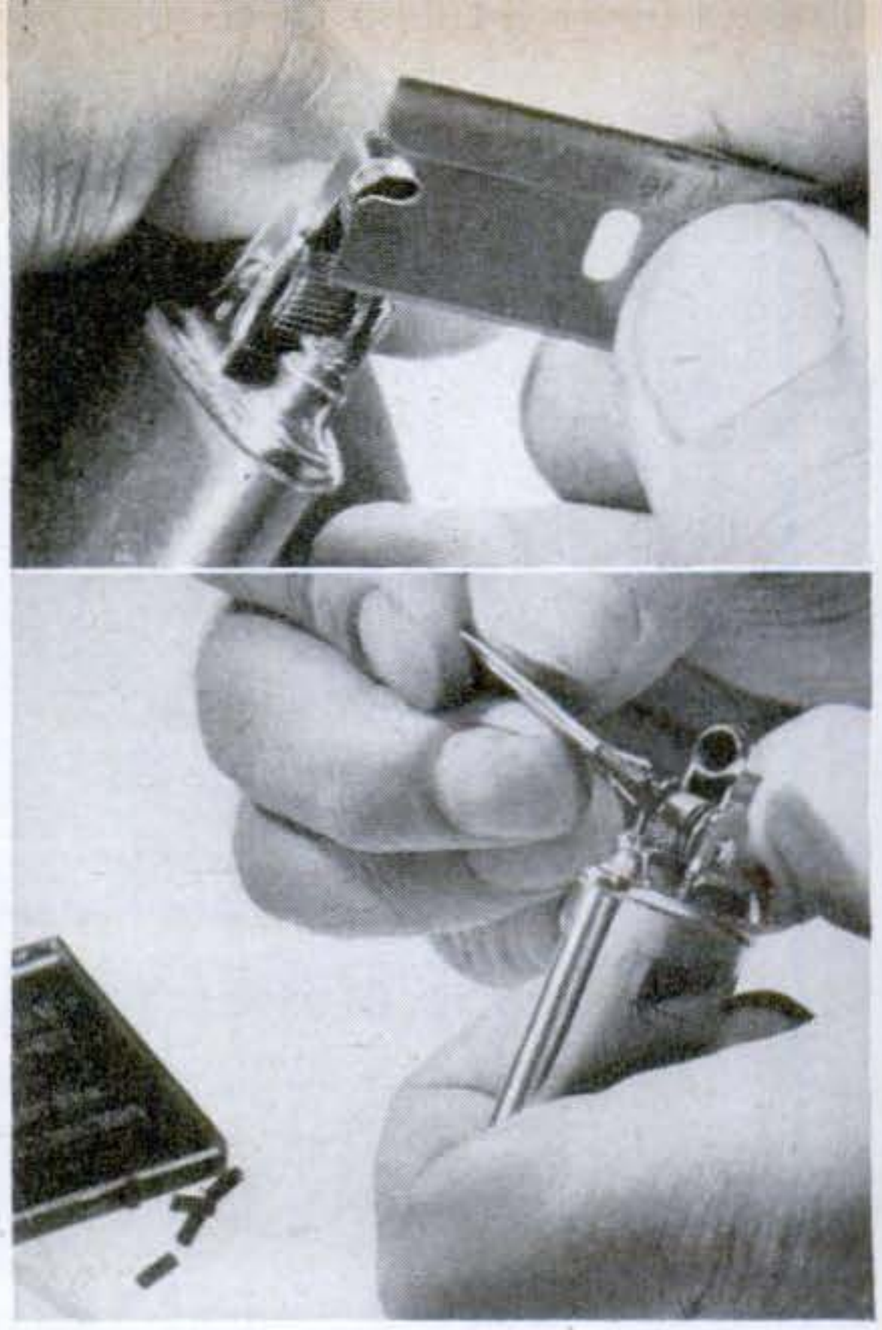
Trouble Shooting Your Lighter

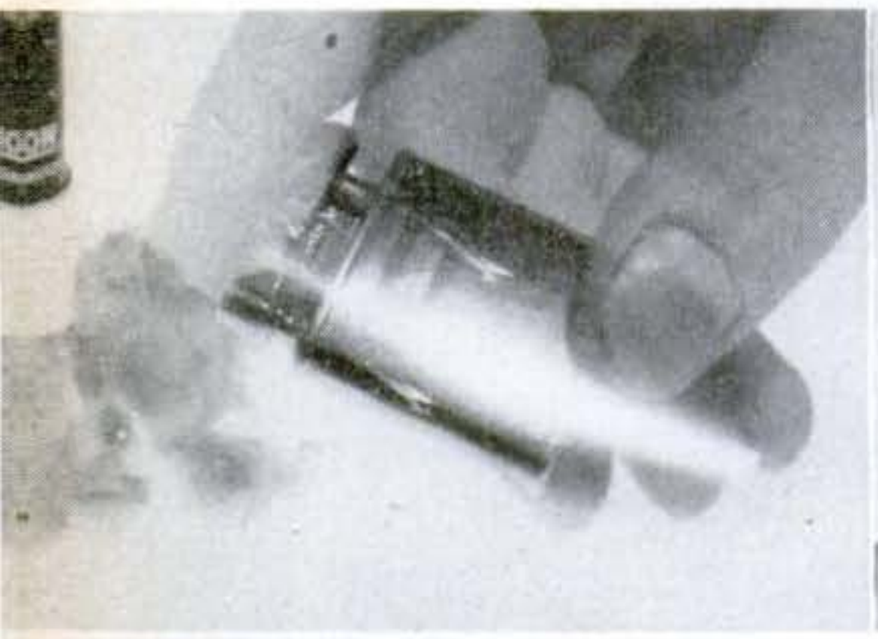
Old Dan'l Boone worked hard with flint and steel but you shouldn't. All you need may be a clean wheel or new wick.

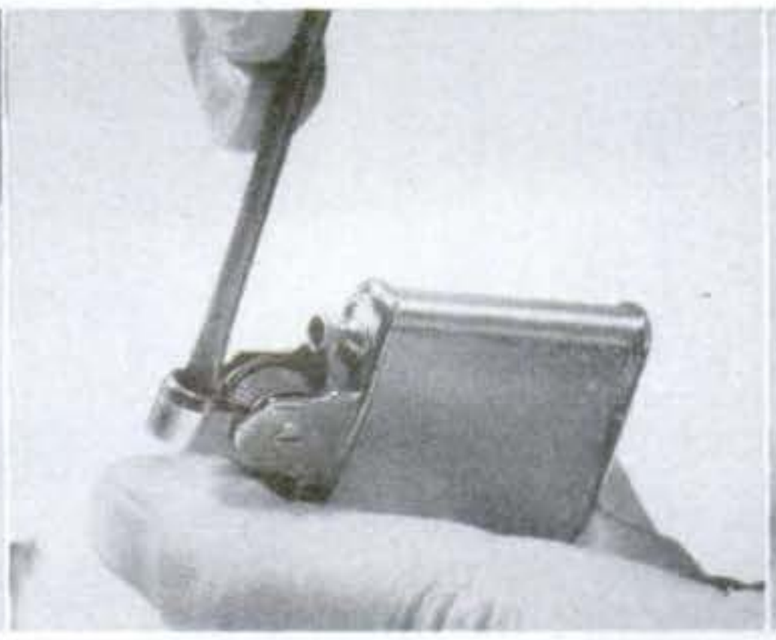


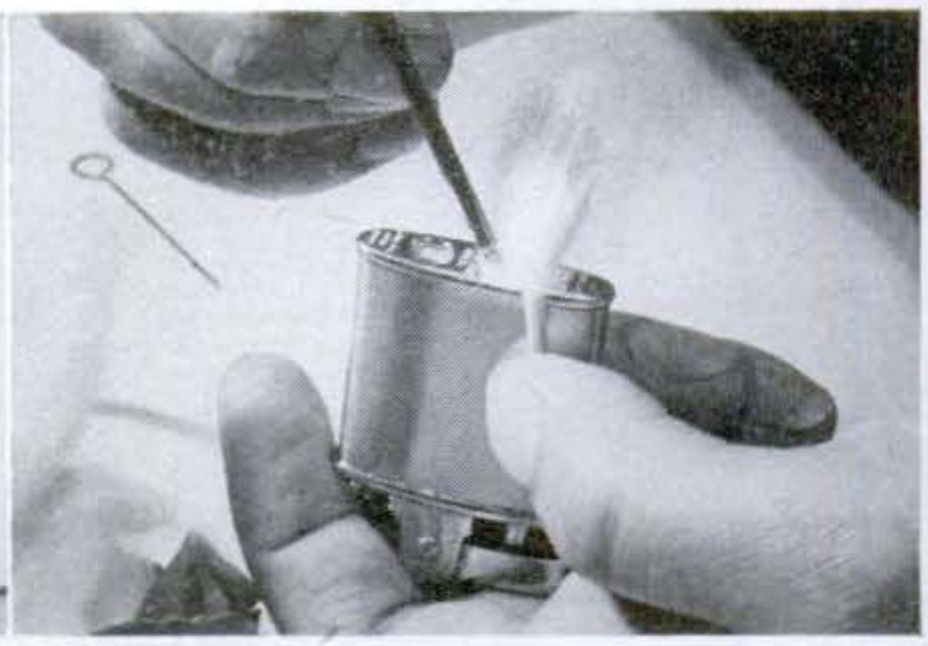
By Robert Gorman



1 Clean wheel first. Weak spark means few lights. Use needle or corner of razor blade to clean hard-packed flint dust from wheel teeth. Regular cleaning can be done with brush in 25-cent service kit available at most tobacco shops.





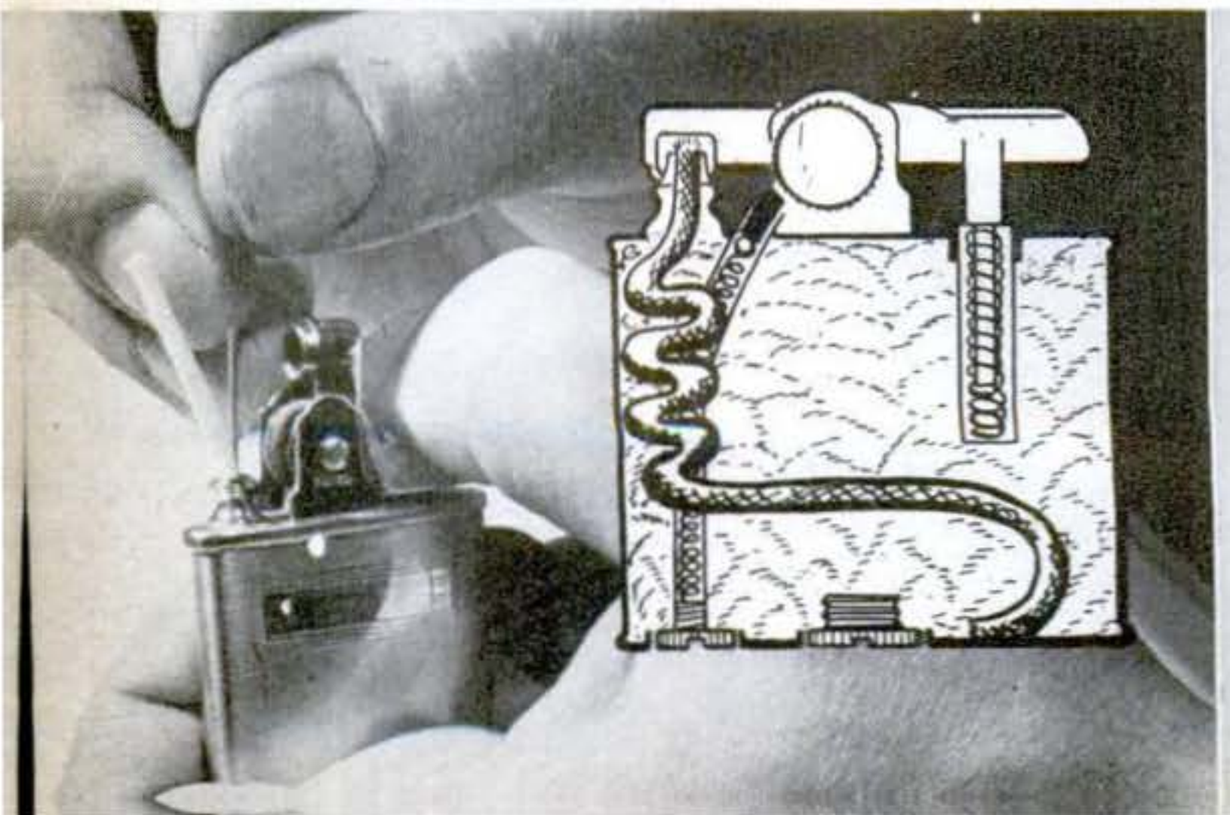


2 Check for leaks. If lighter needs refilling frequently, fluid is probably evaporating. Remove wick and packing, and pour a little fluid into fuel chamber. Then shake lighter vigorously and watch for damp areas around snuffer cap and filler screw. Poke out grit or soot inside snuffer cap to make it seat tightly. Replace washer if leak is at filler screw.

3 Replace wick and packing. A new long wick will carry more fuel to where it's needed and new cotton packing will store more of the fuel than the old packed-down cotton.

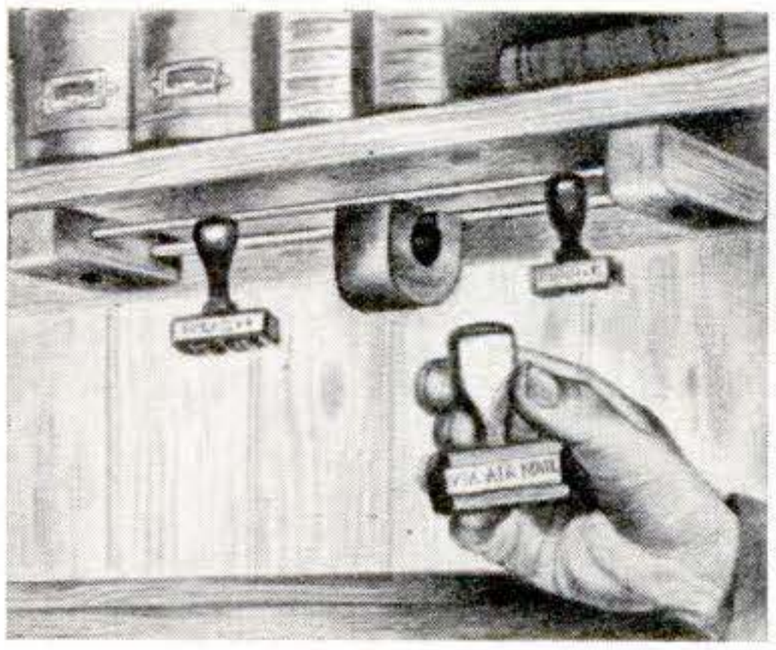
4 Push last of wick down after packing is in place to form a coil of wicking near top. It can then be easily pulled up as it burns away. Sketch shows how wick should lie.

5 Fill lighter and insert flint. If sparker has spring action, break in new flint by lifting snuffer cap gently a few times instead of bearing down hard on wheel lever.



ADD A MAGNET to an automatic can opener to catch the lids. Bracket supports magnet in position for all size cans.

MAGNETIC RACK holds rubber stamps, small tools. Iron rods are charged by magnet. Washers bradded to handles cling to rods.

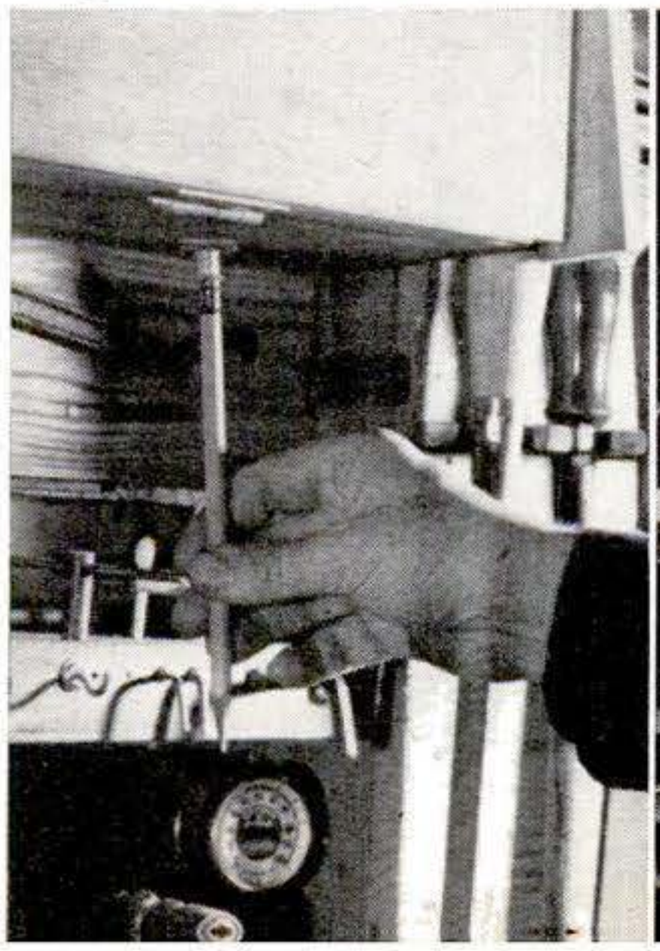


GAS-TANK CAPS can be parked on magnet attached to pump. Put cap on magnet as you take down hose. Then you can't miss it when hose is put back.

Let Magnets Lend a Hand

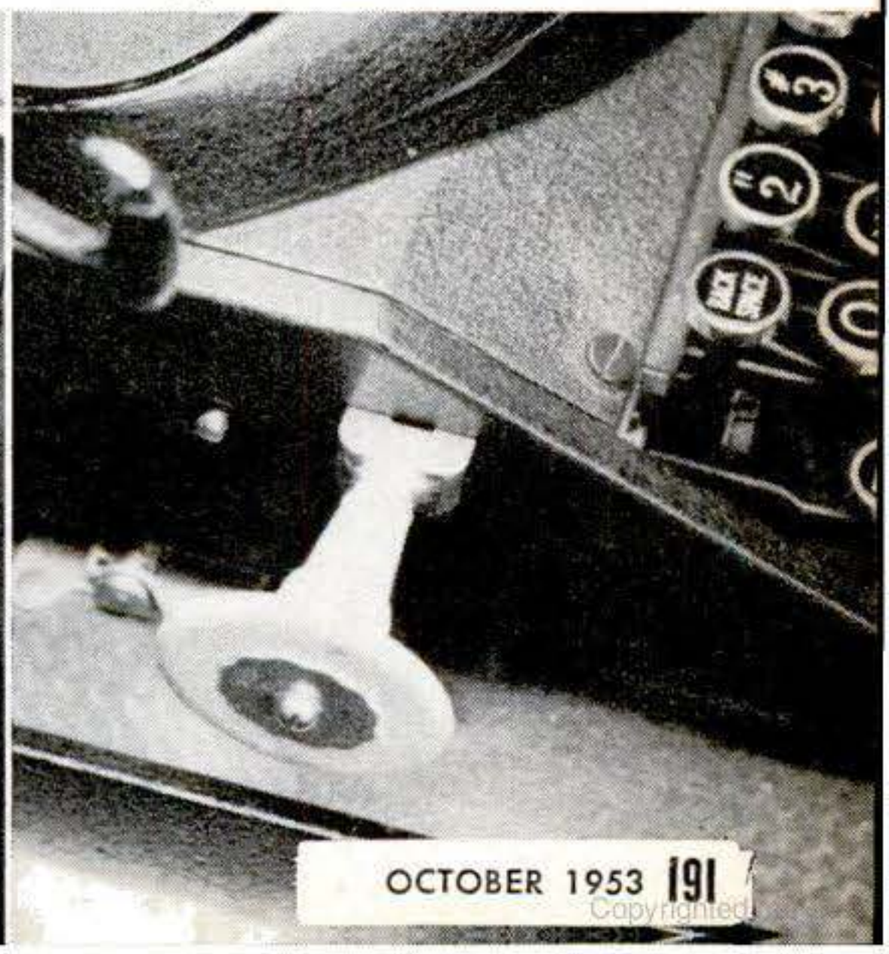
Little alnicos, now widely available, have a strong attachment for iron and steel. Here are some ways you can use them.

SHOP PENCIL is always available if magnet is pressed on eraser. It will hang in plain sight from a steel hinge or bracket.

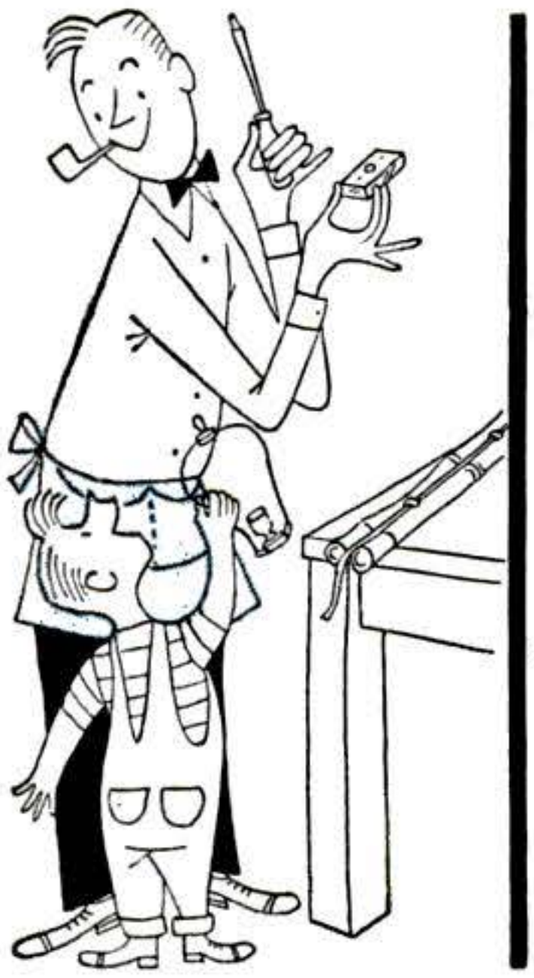


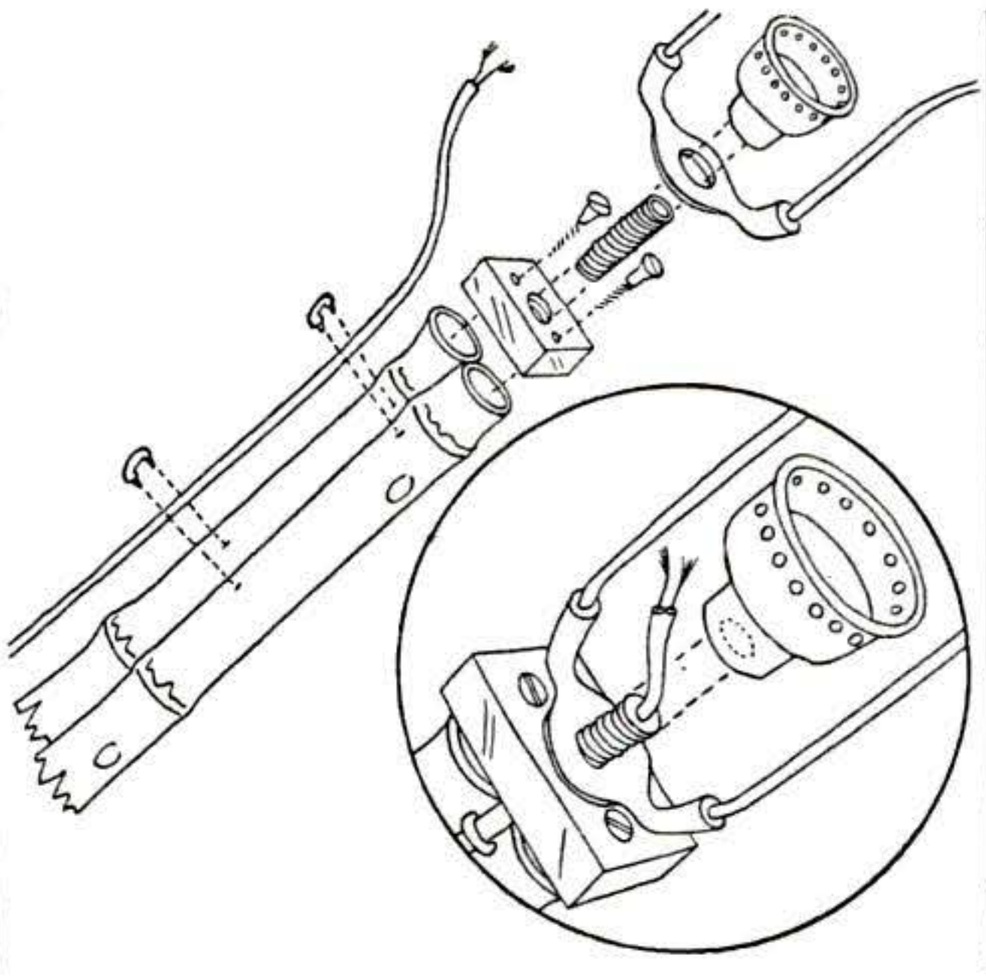
TWO MAGNETS placed on corners of cloth will hold it in place to protect fender while you work on motor. Cloth will even stick to vertical panels.

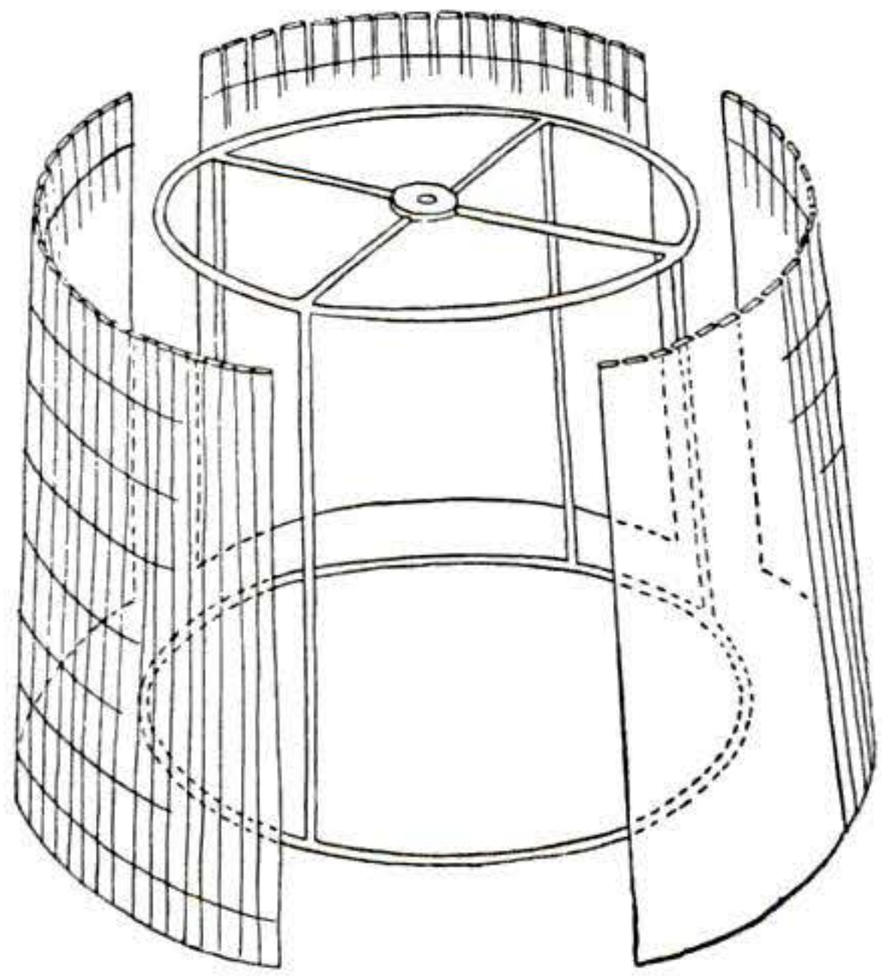
ELUSIVE TYPEWRITER ERASER is always by your side when screwed to the handle of a magnet and parked right on the typewriter frame.



Wordless Workshop







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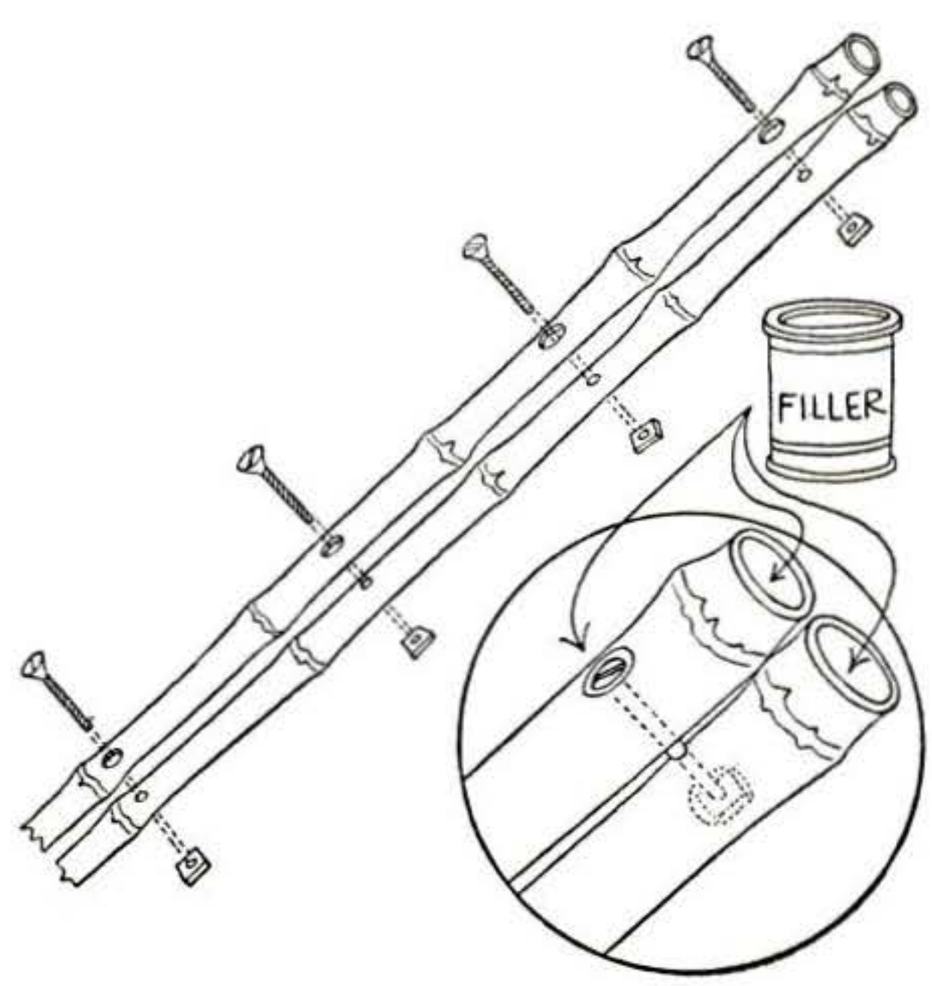

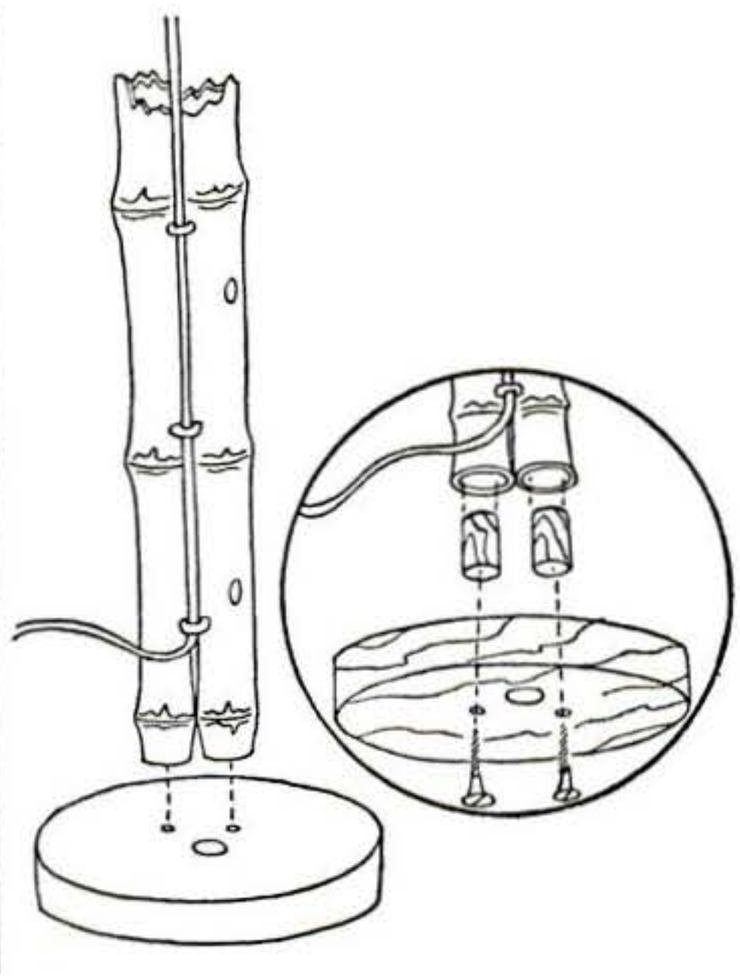

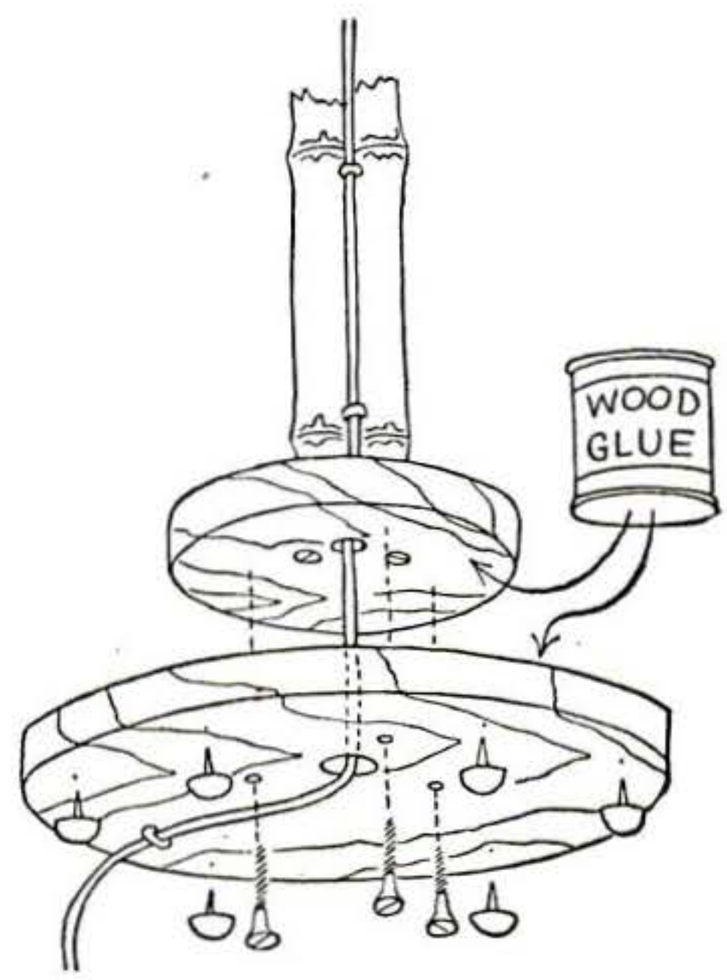

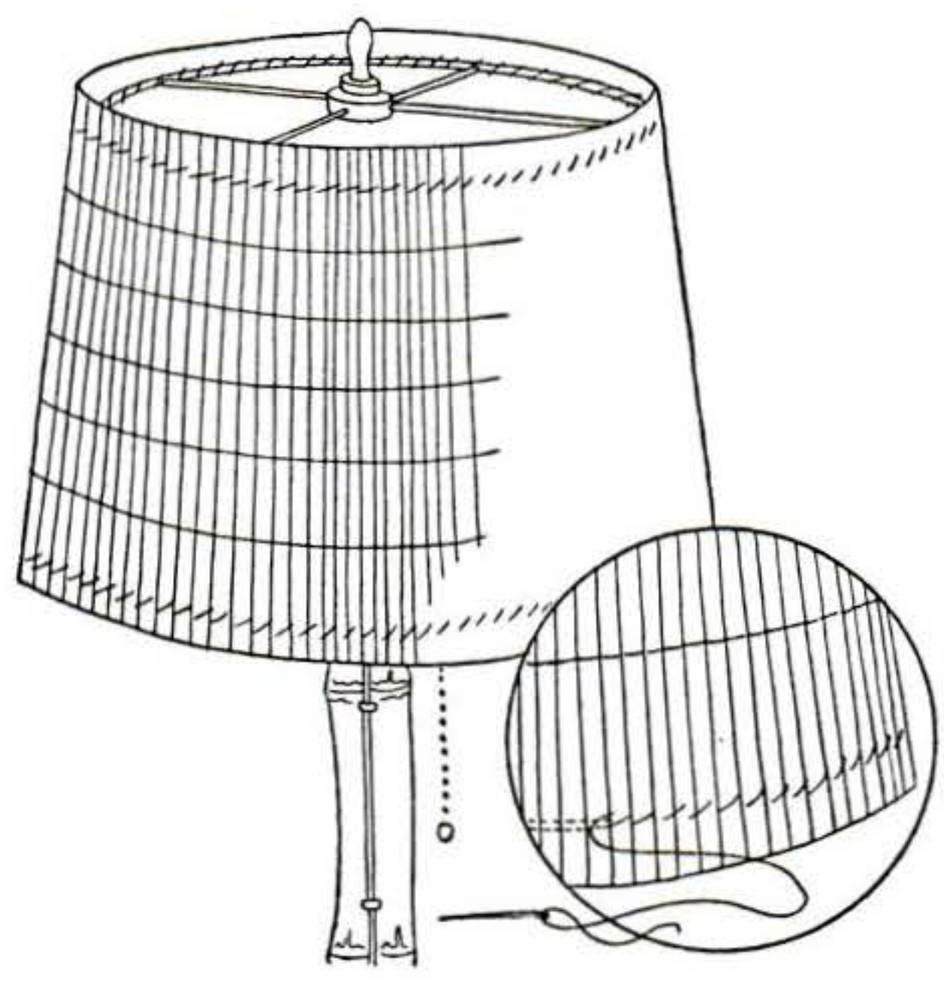

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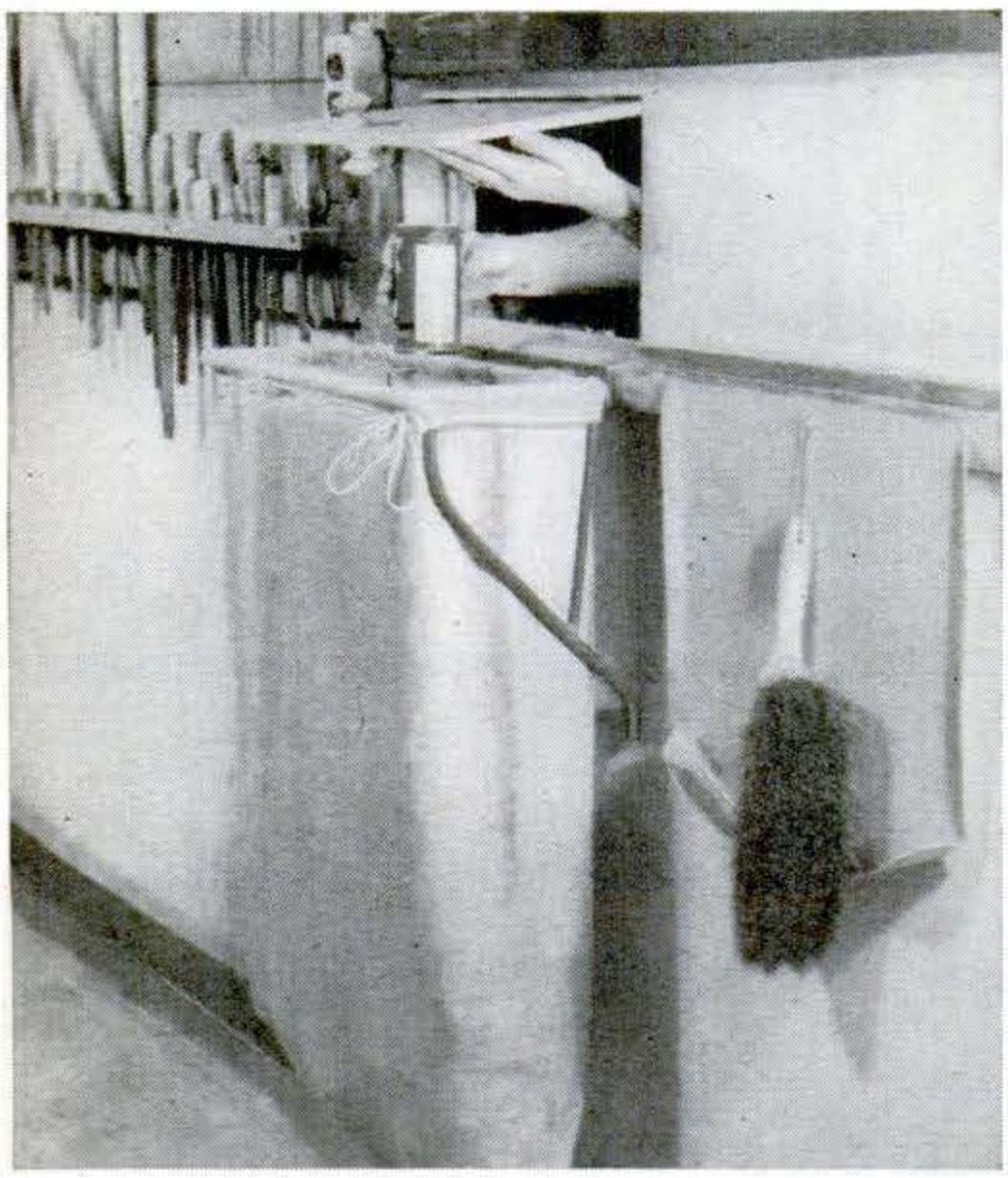
Here's a Handy Shop Table

IF YOU can put your hands on a discarded sewing machine, you have the start of a useful shop table. Remove the machine and treadle, then bolt a piece of plywood on top. Light, strong and just the right height for sit-down jobs, the table will roll easily on the original casters.—*E. V. Reyner, Townsend, Mont.*



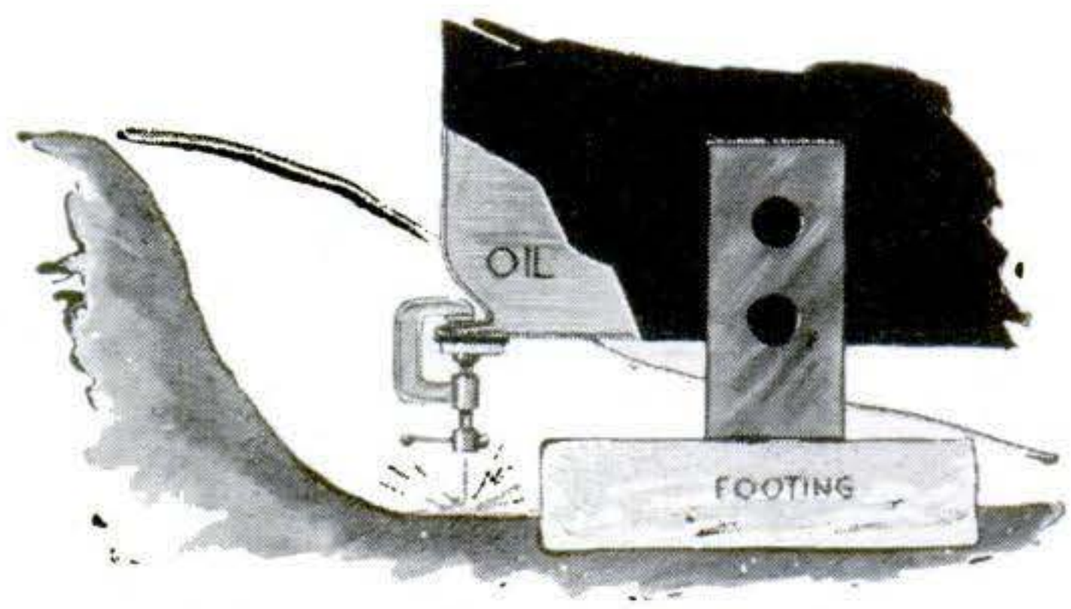
Trash Sack Does Double Duty

THIS empty feed sack collects trash from the workshop where it is located and also from the kitchen on the other side of the wall. Hung off the floor on a simple welded frame, it is reached from the kitchen through a small top-hinged door cut in the wall. The cord laced through the top holds it on the frame.

Water Rocks Developing Tank

WATER from a faucet tips this agitating rig back and forth, freeing the photographer for other chores. The wood base pivots on a bent-wire frame. The developing tank rests in a center recess and tuna fish cans are attached at the ends. Two small funnels, with rims soldered together, are soldered to copper tubes which, in turn, are soldered to the inside of the cans.

As water fills one can, the weight tips the rig. The first can empties, the second one fills. Holes in the cans keep water constantly draining.—*Robert Gilmore, Sonoma, Calif.*



Emergency Repair for Fuel Tank

A LEAK in the side of a fuel-oil tank can be stopped easily with a boiler plug. The trouble is that most leaks occur at the base where the metal is exposed to the dampness of the ground.

I found such a leak in my tank. Years of contact with a dirt floor had rusted a portion of the flange along the back. A C clamp, a small block of wood and a piece of inner tube sealed the leak temporarily as shown. I still have to buy a new tank, but at least I saved the expensive oil.—*C. B. Colby, Briarcliff Manor, N. Y.*

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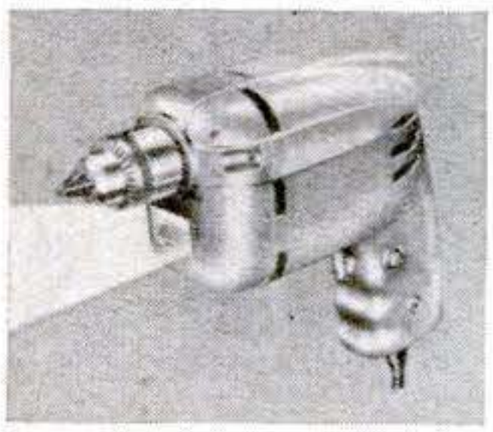
New Tools

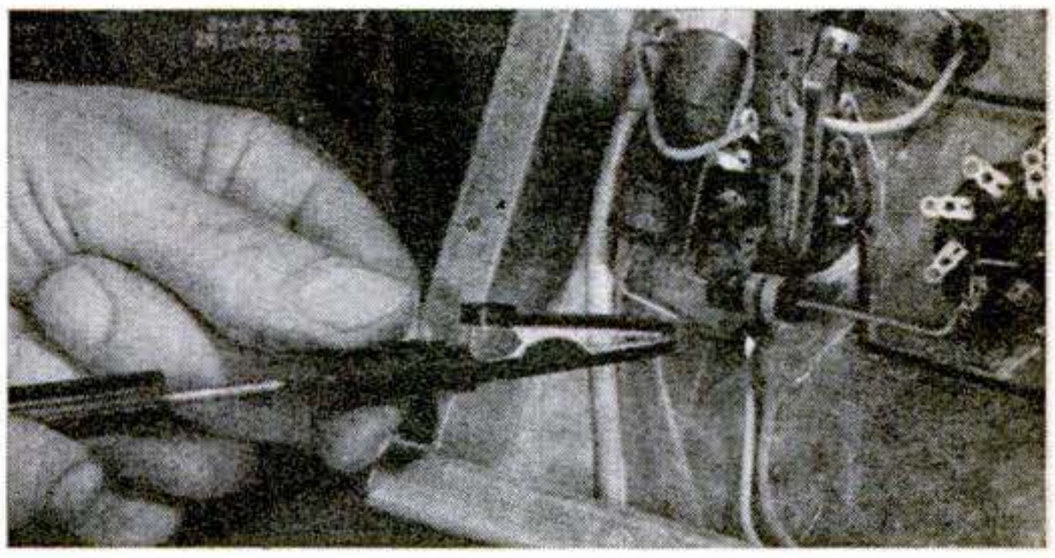
1. Vise Does Three Jobs. You can clamp wood, metal and pipe in this three-way combination vise. Wide aluminum jaws fit over the regular ones, giving a 3″-by-5″ work surface for holding wood. Each jaw is quickly attached by simply slipping in a single ordinary nail (left above). By removing the pin from the stationary jaw, the jaw will pivot to clamp any angle of tapered stock.

The cast-in curved jaws (right) take pipe from ¼″ to 1″ in diameter. The vise has a swivel base and an anvil, and opens to 5″ with the wood jaws attached.

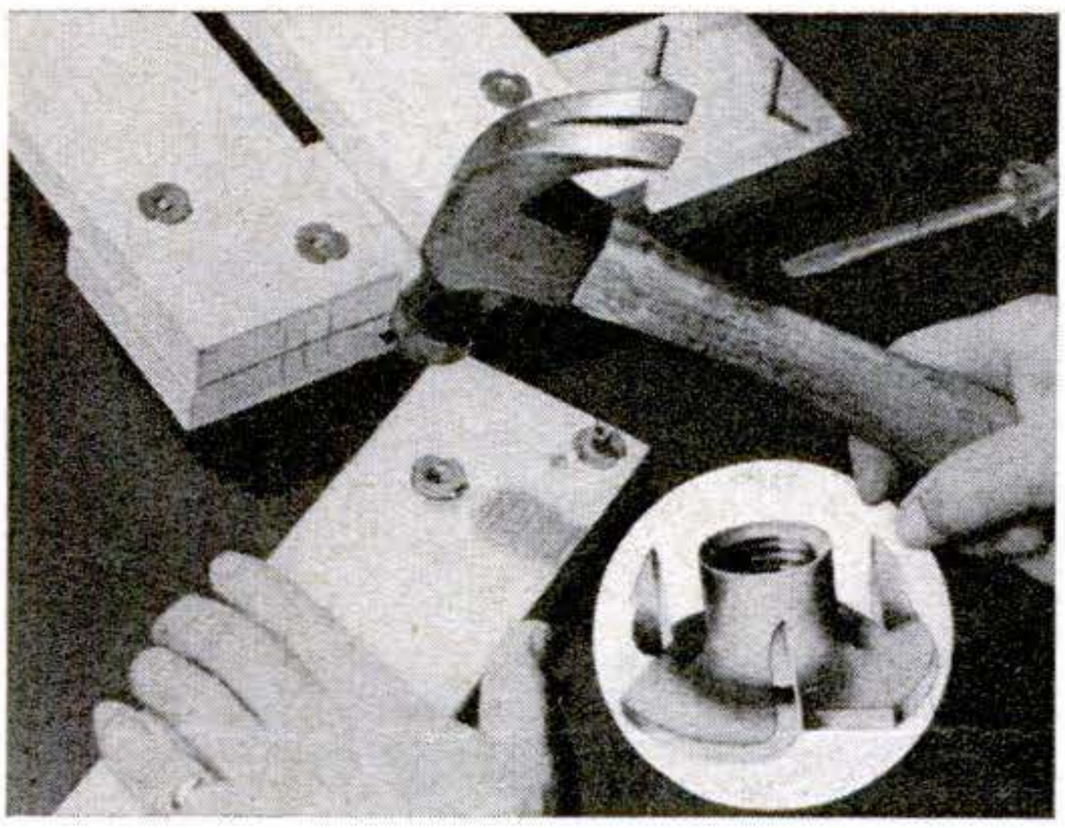


2. Drill Lights Its Own Way. Drilling in small, dark, hard-to-reach spots is no problem for this new ¼″ electric drill. A tiny light set in the front housing shines a beam right on the drill point, making it easy to see what you are doing without a separate work light.

The drill has a geared chuck and a two-amp. universal motor. Its no-load speed is 2,100 r.p.m., and its full-load speed is 1,000 r.p.m.



3. Clips Fit Test Prods. Ordinary electrical test prods can be quickly converted to clamp-on connectors with these special alligator clips. A spring collar holds the clips on the prod tip.



4. Nuts Hold Bolts in Wood. You can put steel threads in wood with these special fasteners. Long used commercially, but now available for home use, the nuts are simply hammered into predrilled holes, providing threaded barrels to hold bolts. The nuts lie flat without countersinking and are kept from turning by sharp prongs driven into the wood.

Seven different sizes of nuts are available to fit standard bolts. They are useful for wood to metal applications and where old screw holes in wood have become worn and won't hold.

Further information on these products can be obtained from: 1. Yost Manufacturing Co., Meadville, Pa.; 2. Fairchild Industries, Burlington, Vt.; 3. Industrial Devices, Inc., Edgewater, N. J.; 4. Columbia Fastener Co., 3229 S. Ashland, Chicago.

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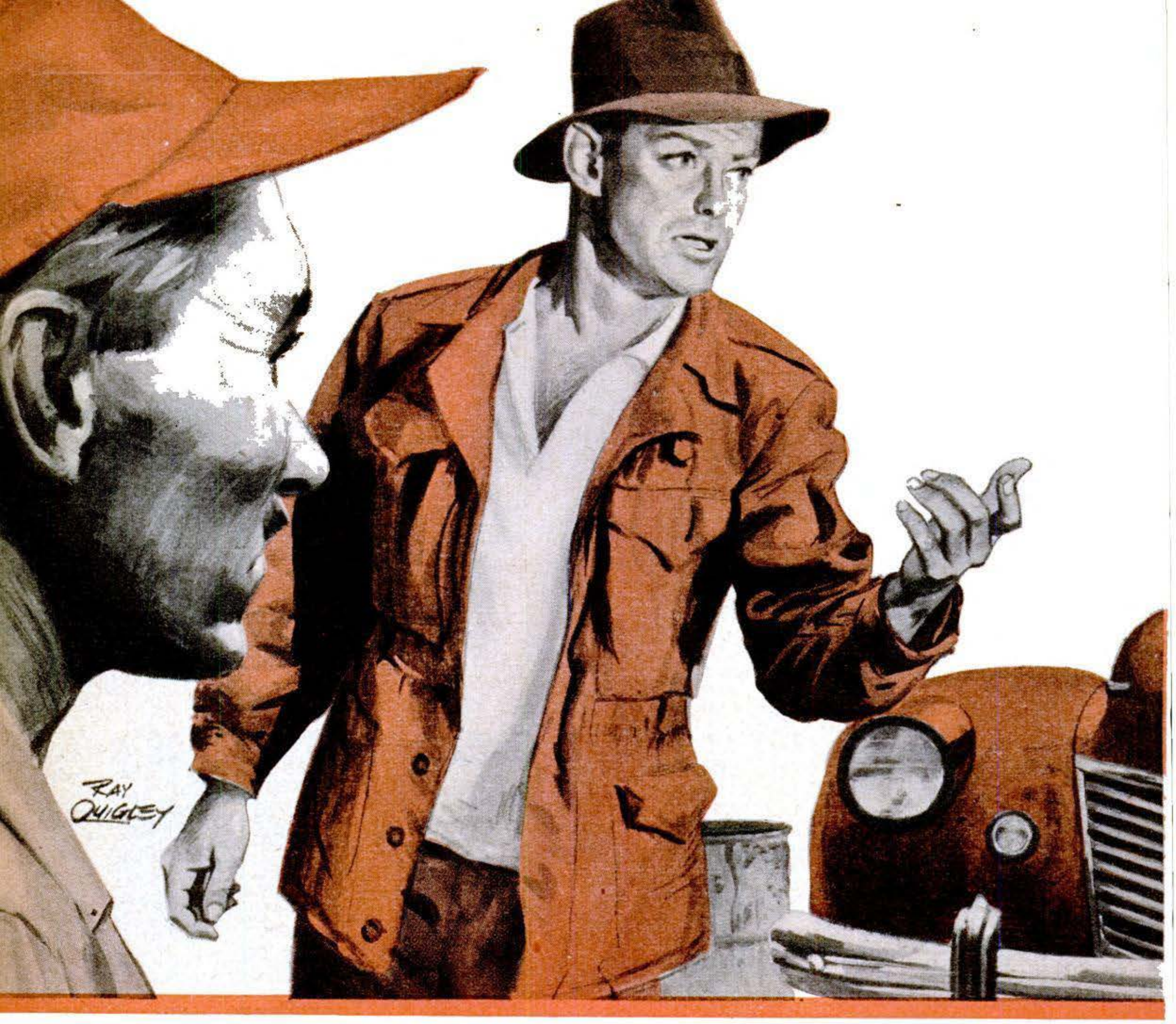

Gus and the Job That Backfired

By Martin Bunn

ELMER STODDARD'S sedan progressed with jerky lunges, backfiring thunderously and trailing a dribble of oil across the cement apron of the Model Garage. The car shuddered to a stop in front of Gus and quit stone cold with one final shake.

"Of all the quivering, backfiring wrecks I've ever encountered this is the worst," Stoddard exclaimed as he slid out from behind the wheel. "Fix her up in a hurry, Gus. We're going fishing at the lake."

Gus looked from Stoddard to his passen-

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"I'm using this dough to take the gang to lunch," Gus told Stoddard. "Let's go, the grub's on you."

ger, Pete Vancourt, and grinned broadly.

"Why should I fix you up," he asked, "so you can go out and fish my favorite lake? What's the matter with this boiler, anyway?"

"That," declared Pete Vancourt, his eyes twinkling, "is what we brought it in here for, Gus. If we'd known what was wrong we'd have fixed it ourselves."

Gus Finds a Loose Battery Cable

Gus glanced at the stranger who had walked in just before Stoddard drove up—a gray-haired, well-dressed, middle-aged individual. The man smiled and said, "Don't mind me. I'm just killing time. Fix the boys up—I'm a fisherman myself."

Gus slid under the wheel and stepped on the starter of the Stoddard sedan, getting no response. The car was as dead as a doornail, and Gus immediately blamed the backfiring on a loose battery ground cable. He slid under the car on a creeper and found that the bolt which held the negative battery cable to the frame was loose. It was so loose that the nut was about to fall off, and allowed the bare end of the cable connection to bounce up and down on the edge of the frame, making and breaking contact. Convinced that he had found the trouble, Gus tightened the bolt, got out from under and again stepped on the starter. Still no response.

He got out, lifted the hood, cleaned and tightened the battery terminals, checked the battery for charge and tightened both terminals on the starter button. Again the starter refused to work, and Gus's mind turned to the starter button itself. He placed the ends of the handles of his pliers on the two starter-button terminals, thus

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cutting it out of the circuit. The starter failed to turn over. Thoroughly puzzled now, he picked up a test battery with two long cables attached, and applied one cable directly to the starter post, the other to the frame for a ground. Instantly the starter spun the motor.

"Got you whipped, Gus?" Pete Vancourt inquired.

Stan Hicks, standing beside Gus, snorted at the suggestion and went back to the grease rack. Gus went under the car again, took out the bolt that held the ground wire to the frame, intending to scrape bolt and terminal bright, in case corrosion was interfering with proper battery ground. The bolt, he saw, had a flat washer between the battery terminal and the frame, and another between the frame and the nut. This wasn't usual. Curious, Gus flashed his pencil light on the deal, and Stan Hicks heard him give a low whistle, and heard the scrape of his knife as he worked. With the bolt and terminal scraped, Gus tightened things up, and turned his attention to the oil dribble on the floor. Oil was issuing from the back main bearing of the motor. He slid out and faced the two would-be fishermen with a slow grin. "So," he said, "you boys were going fishin', eh? Just a nice, little, innocent fishing trip."

"Hey, Mac . . . Did'ja know there's a leak in your gas tank?"

"We are," Pete Vancourt said, "when you get through playing around and get us rolling. You've been on this job 15 minutes now."

"Timing me, eh?" Gus remarked, tamping a charge of tobacco in his pipe and lighting it. "My pals."

Gus Revs Up the Motor

This time when Gus stepped on the starter with the ignition on, the motor started. When he revved it up it backfired so explosively that dust rose from the garage floor.

"Hey!" Stoddard yelled. "Take it easy, Gus. First thing you know you'll blow out my muffler."

"Always happy to sell a *friend* a muffler job," Gus remarked as he switched off the motor. He removed the distributor cap and inspected the arrangement of its six wires. The firing order, he knew, was 1-5-3-6-2-4. Rocking the car in gear, to put the rotor in position to fire No. 1, told Gus that the wires were in their proper order. He flashed his pencil light into the interior of the distributor cap, polished the inside industriously with a clean rag and replaced the cap.

The motor ran smoothly now. Gus revved it up for half a minute, then hopped out to peer beneath. A new gout of oil was dripping from the rear main. Gus picked a rubber mallet from the bench, firmly grasped the oil filler and breather pipe and pulled, tapping the side with the mallet as he did so. The breather pipe came free in his hands. He jammed a long screwdriver blade through it with a punch of the palm, and out dropped a wadded-up piece of dirty rag. Gus grunted, twisted the pipe back into the motor, tapped it solidly in place with the rubber mallet to firmly seat it, turned to face Vancourt and Stoddard.

"Now," he said flatly, "just what are you two screwballs up to? In the first place, you know as well as I do that the fish won't bite on the lake until late afternoon. You just don't go fishing at this time of day, on this kind of a day. You brought this car in here with the battery ground cable so loose that it flopped up and down on the edge of the frame just enough so that the car would stagger into the garage. I fix that and what do I find—carbon pencil marks in the distributor, so that the juice runs from contact point to contact point like a squirrel around a tree. And as if that wasn't enough, there's a rag rammed in the breather pipe. I don't get it."

"It took him," Stoddard said, extending his hand to Pete Vancourt, "just 24 minutes. Not an hour. You owe me 10 bucks—give."

Pete Vancourt looked at Gus with sheepish eyes as he drew out his wallet, extracted 10 dollars and handed the bill to Stoddard.

"Heck," he grumbled, "you must have

[Continued on page 256]

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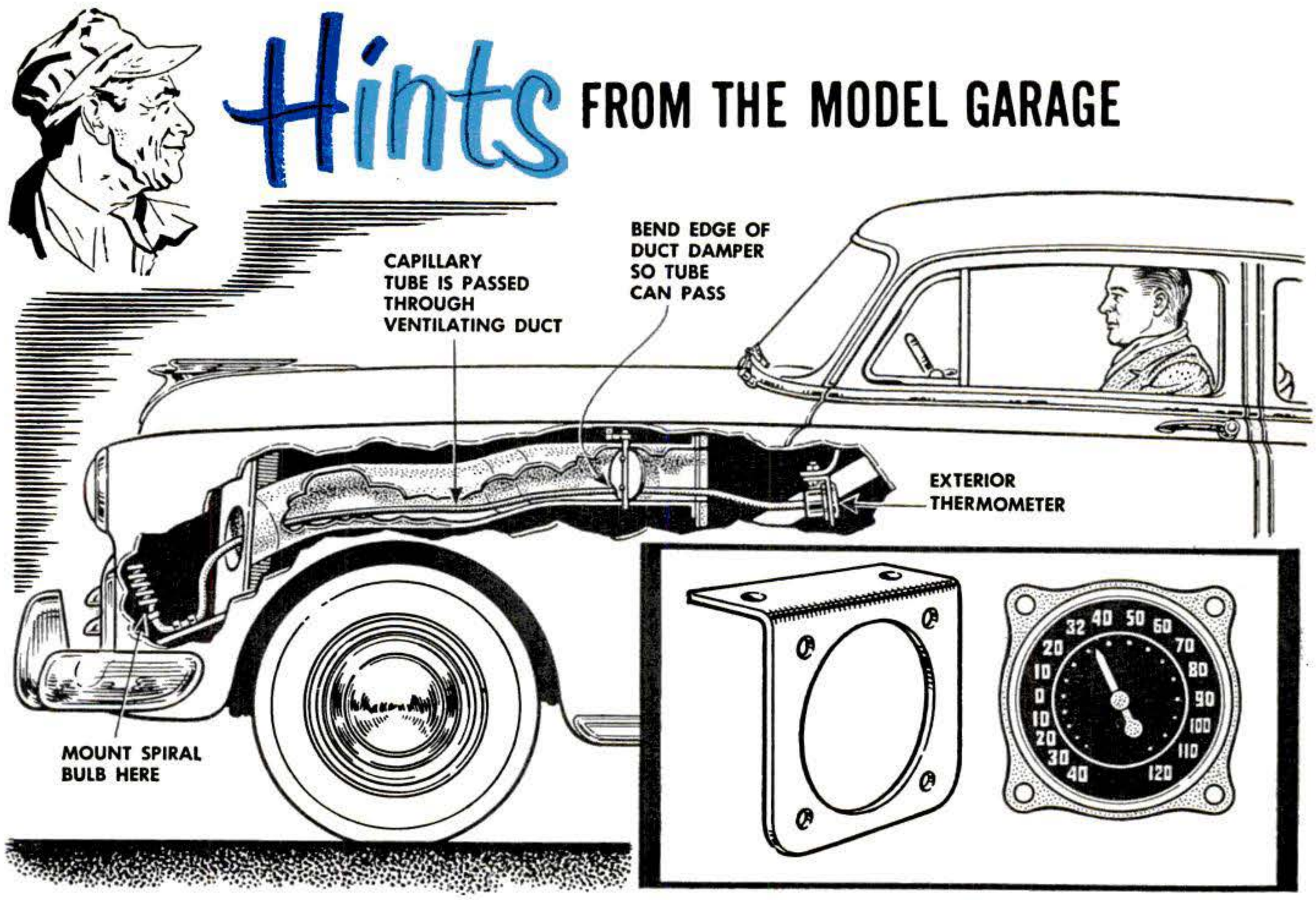
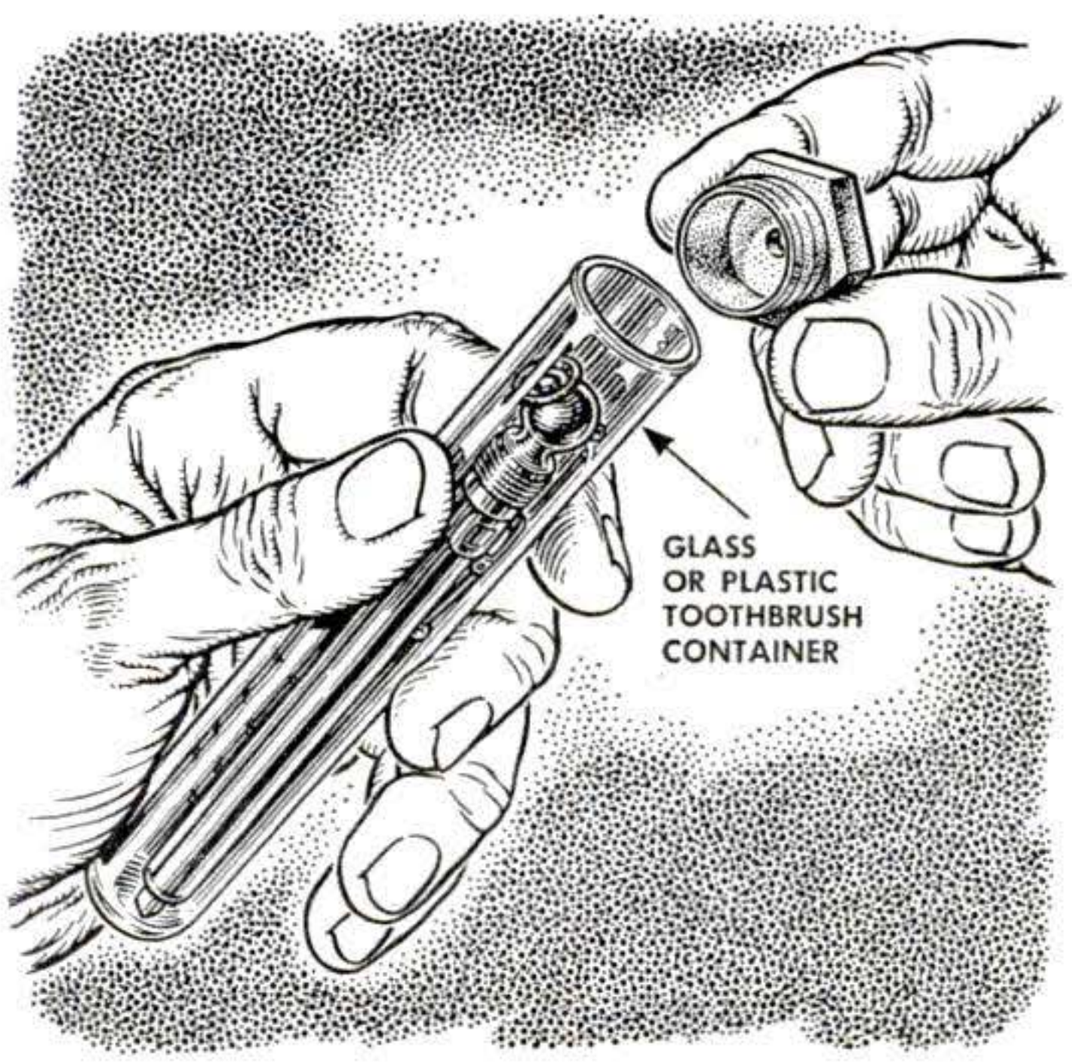
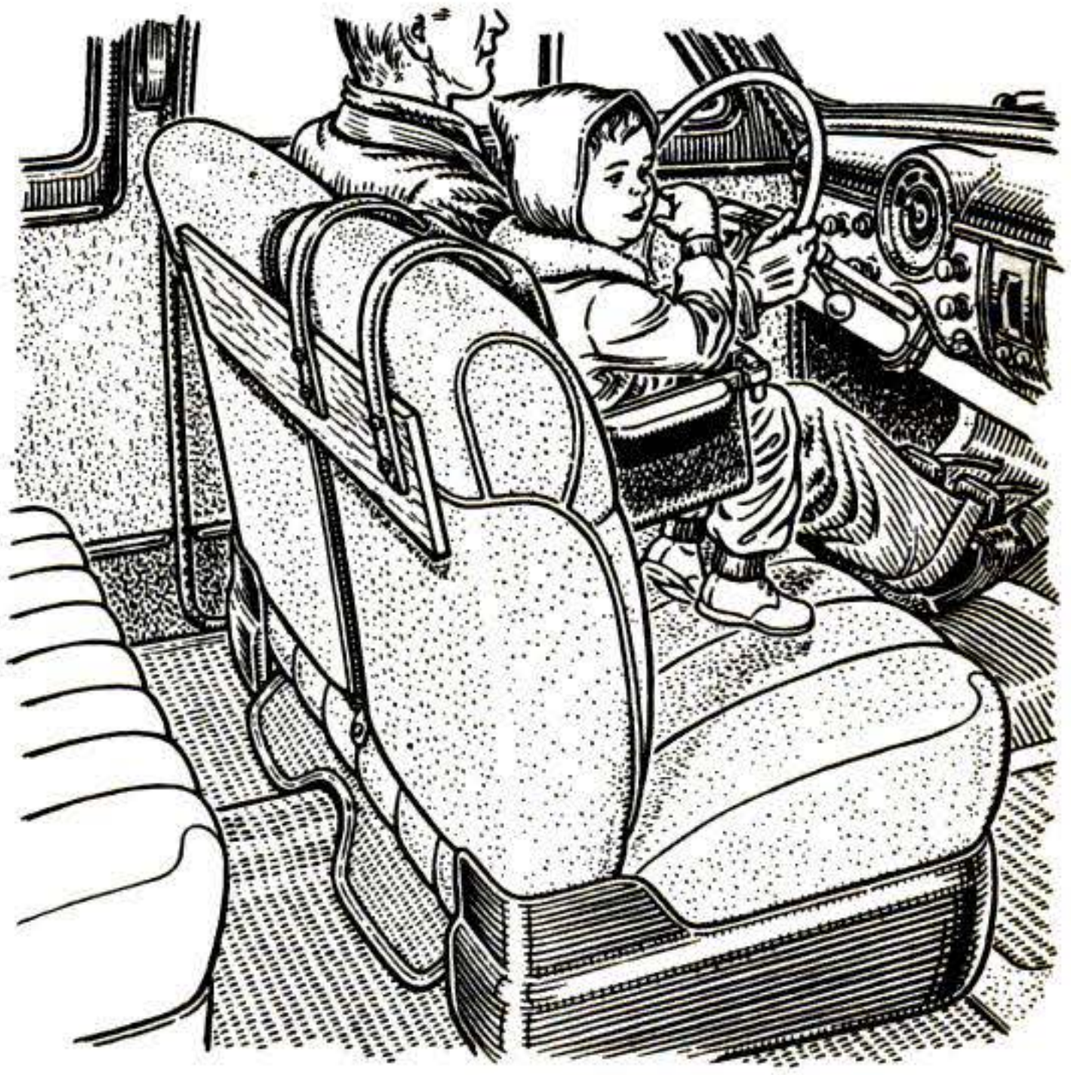
Hints FROM THE MODEL GARAGE



Keeping track of air temperature while you drive may offer a warning of icy conditions ahead, especially when it's near freezing. Here's the setup one driver installed, using instruments obtained from surplus outlets. A vapor-pressure air-temperature indicator, mounted in the vent tube, gives readings on a panel dial.



Gauging tire pressure regularly is a rule it pays every car owner to follow. For this, a reliable gauge is needed. One way of protecting the gauge is to store it in a toothbrush container. Dirt may damage a gauge carried loose in the car.



A baby seat hooked over the passenger seat of a two-door car may pitch the child forward in case of a sudden stop, if the driver is alone. To prevent this, screw the ends of the seat hooks to a board long enough to extend behind the driver's seat.

Please turn the page for more auto hints.

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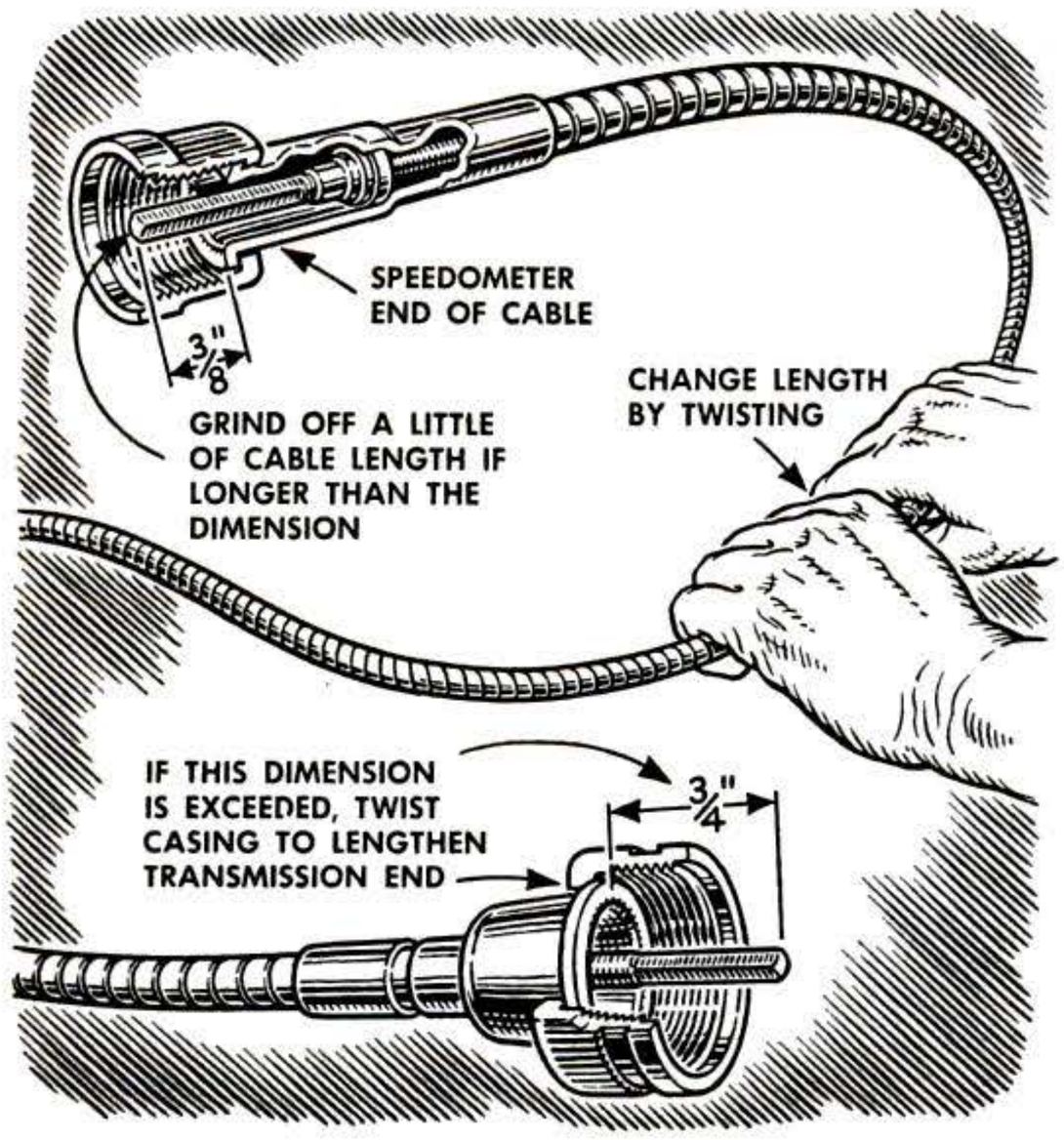
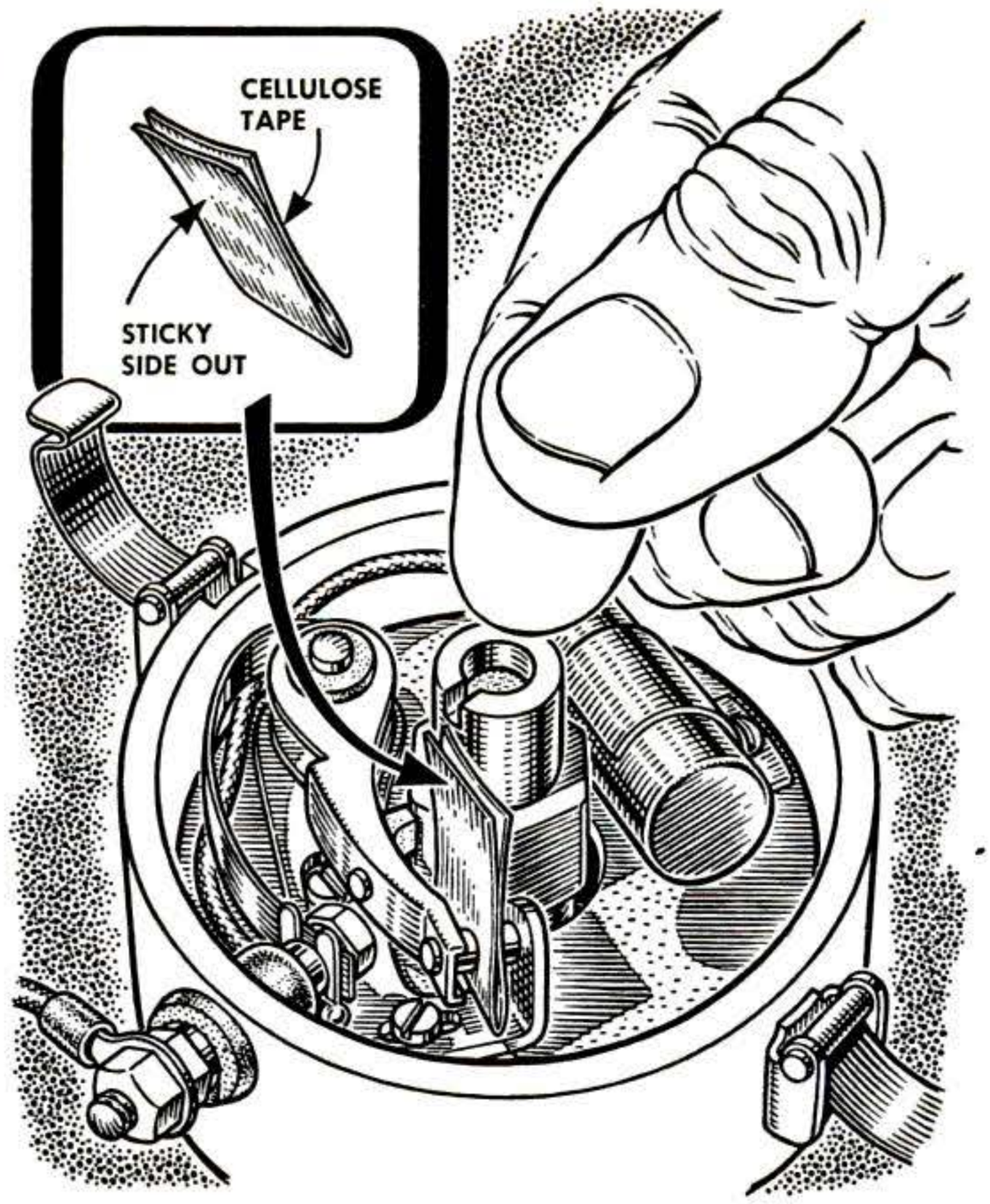
MORE Hints from the Model Garage

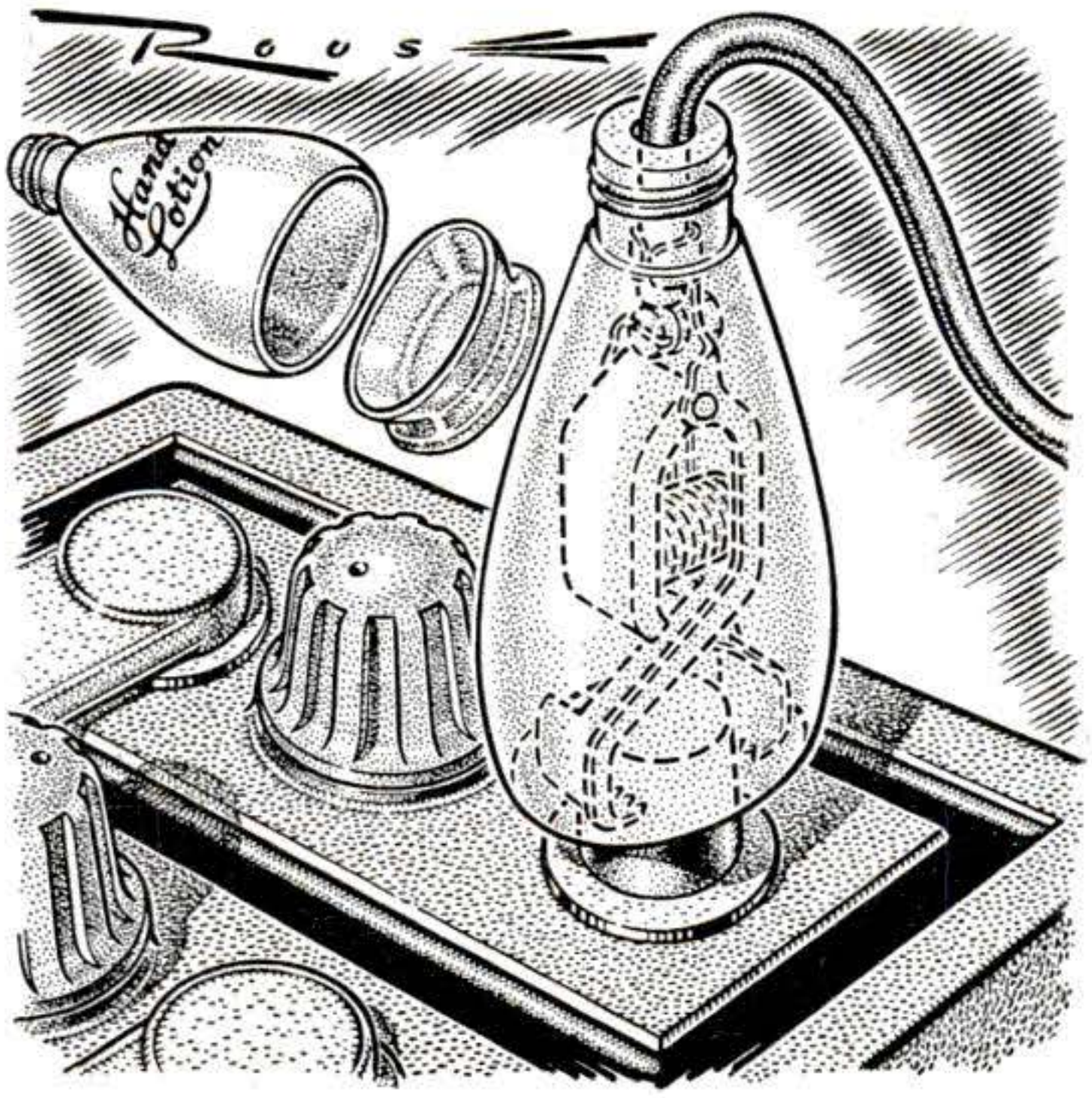


Speedometer noise may result if relative lengths of the cable and casing are not correct. The sketch shows how much the cable usually should extend from the casing at each end. Twisting the casing will shorten or lengthen it as much as ¼".



If you file breaker points, be sure all particles of metal or dirt are removed. One way of doing this: fold cellulose tape with the adhesive side out, press it between the points, bring them together. However, point replacement usually is best.

For applying a cleaner before waxing a car, some owners find a cellulose sponge handier than the usual cloth pad. Wet the sponge and squeeze it dry first. When the sponge is dirty, soap and water will make it as good as new.



In working with several batteries around a shop, there's always a chance the clamps may contact other conductors. Insulating shields for the clamps are easily made from the flexible plastic bottles used for cosmetic sprays and the like.

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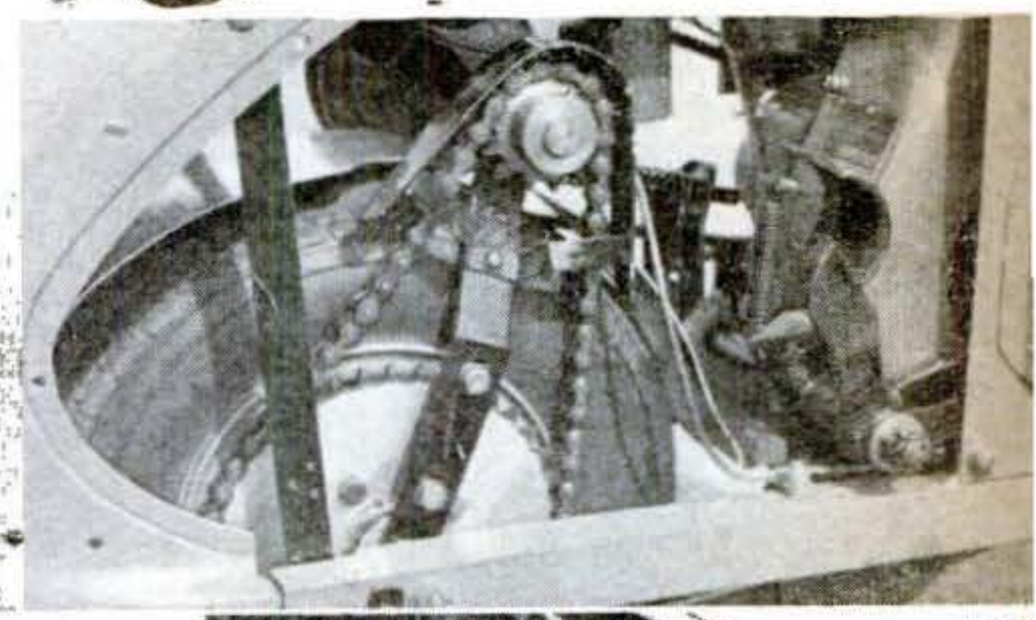
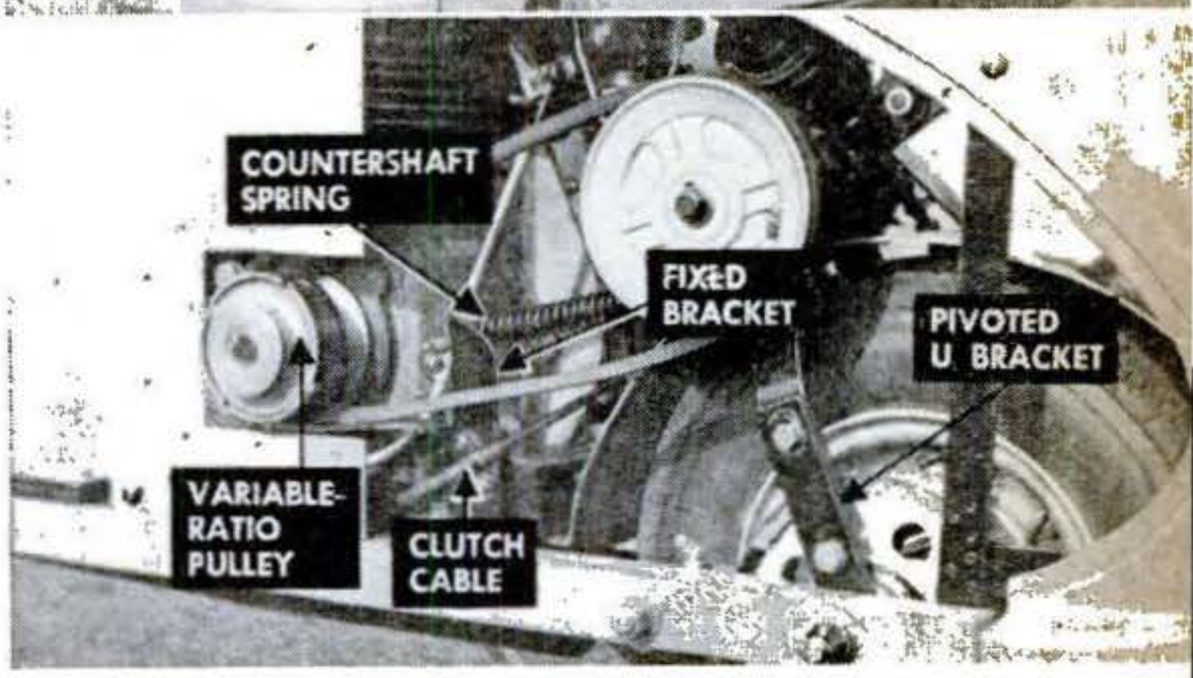
Scooter Shifts Down on Hills

WITH a variable-ratio pulley on your scooter, you'll think nothing of climbing hills or stopping at lights. The pivoted countershaft shown keeps the belt taut as it shifts up or down between the flanges of such a pulley. As the countershaft bracket pivots on the rear axle, the spacing of the chain sprockets is constant.

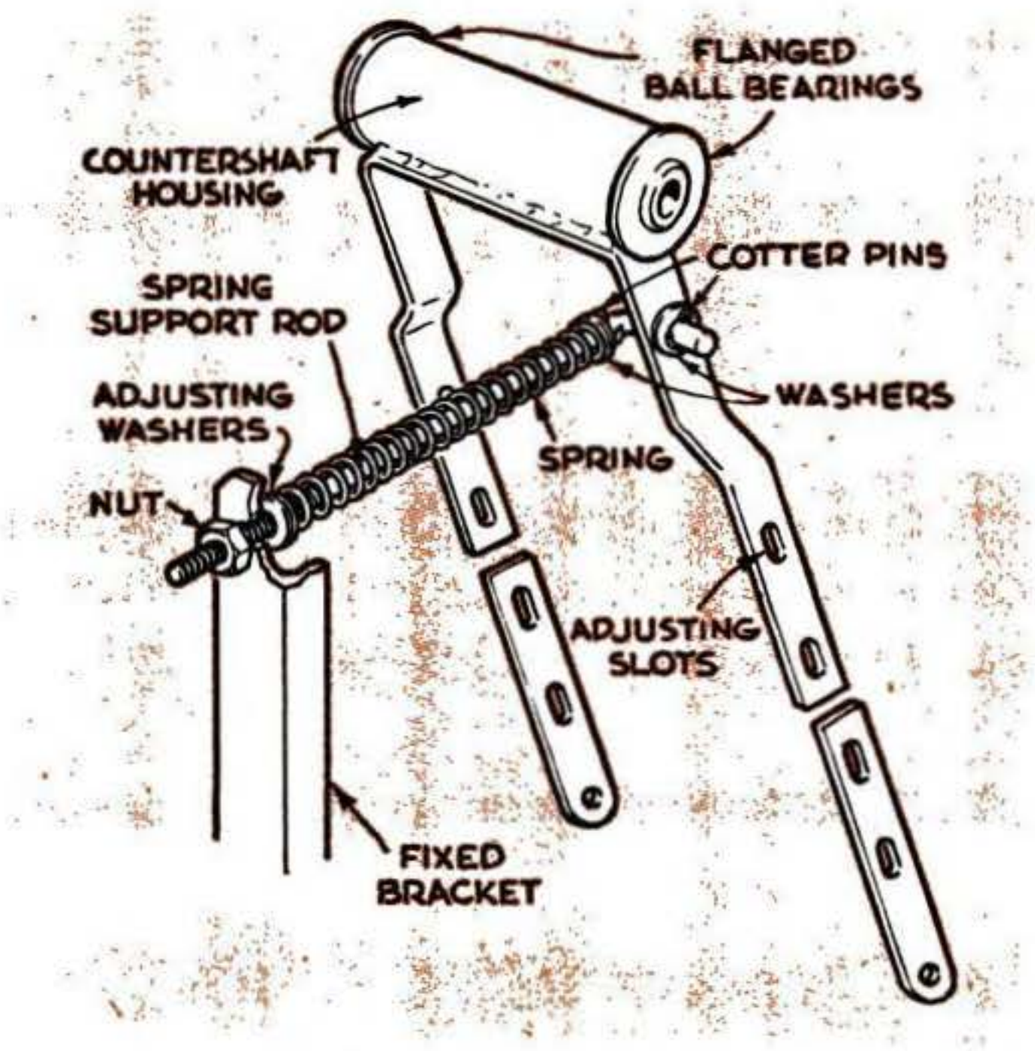
The scooter shown has a top speed of about 30 m.p.h. At about 16 m.p.h., the pulley shifts the belt to high. On a hill or in traffic, it drops back to low at about 11 m.p.h. Both shift points can be raised by tightening the countershaft spring.

With the spring set to give these shift points, the belt first ran too loose. The pulley was disassembled and a segment of brass tubing bolted to each of the four internal weights to make them heavier. This made the flanges grip harder, and did the trick.—*Howard McEntee, Ridgewood, N. J.*





BELT SIDE of countershaft (lower photo) shows compression spring and its bracket. Some drive pulleys provide clutch effect when engine idles; this one did not, so a flexible cable was rigged to pull countershaft forward at stops or to start the engine.



COUNTERSHAFT SUPPORT consists of a U-shaped bracket welded to a piece of pipe in which shaft turns, and two legs that pivot on rear axle. Slots permit adjusting chain.

Discarded Auto Transmission Makes Sturdy Hand Winch

AN OLD transmission from a car or light truck is the backbone of this portable hand winch. A crank, a small drum and a wooden base complete the outfit. Bolted to the floor, it will pull boats out of the water or haul hay up into the hayloft. It can be lashed to a tree or pole to pit its power against tree stumps, fence posts or heavy rocks. Shift to low gear for lifting a heavy load, to high gear for quickly raising a light load. The rig can also serve as pulling power for a single-sheave block fastened to a tree or a building for lifting heavy loads.—*Harry J. Miller, Philadelphia.*

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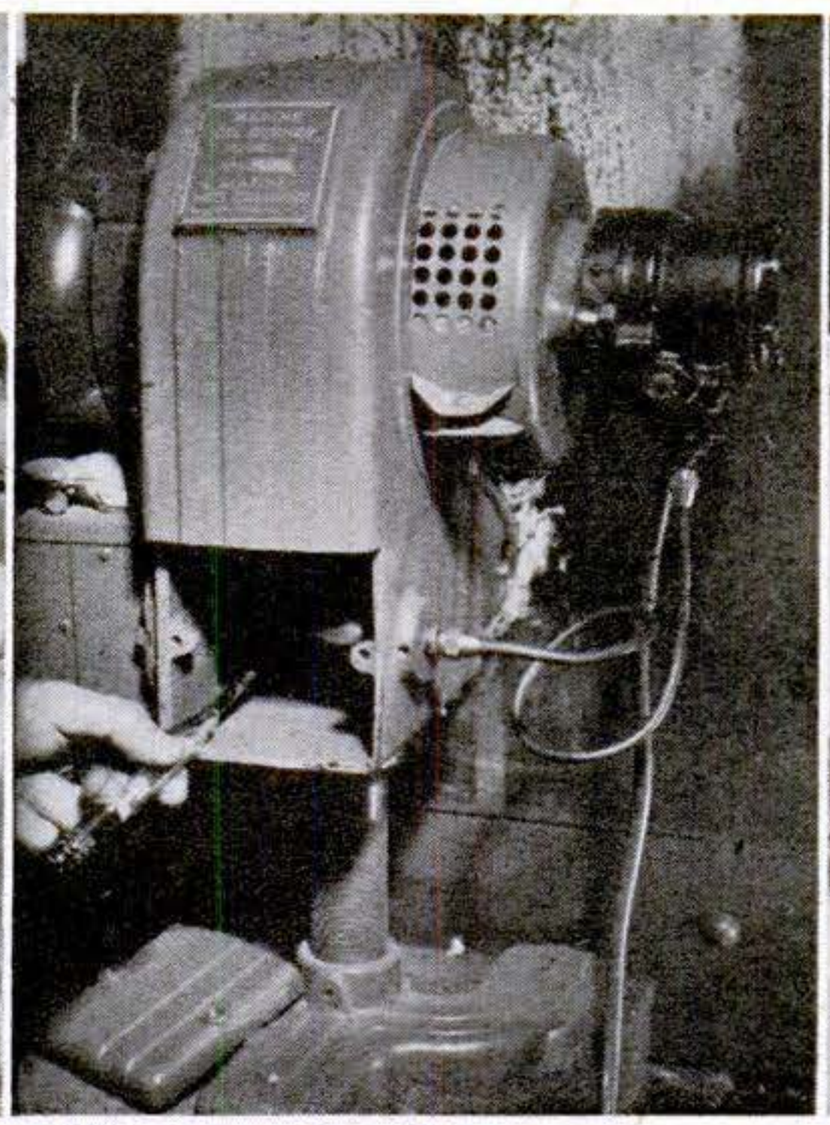
Check your car plugs . . .



oil-burner ignition . . .

small engines.

Red flashes emitted by this little instrument will put you on the beam when you're tracking down ignition trouble.

By E. F. Lindsley

A SPARK-PLUG tester's keen nose can sniff out automobile plugs that waste enough gasoline every week to cover its original cost. Used to forestall trouble, it offers first-rate insurance against highway breakdowns. If trouble does show up, you can spot the source yourself—and perhaps reduce the repair bill. You'll use one most around a car, but it's also good for a power mower, outboard or spark-ignition oil burner.

Most testers look something like the pencils that are given away for advertising. The resemblance ends there, however, because the tube contains neon gas, and in place of lead at the tip some testers have a sharp needle to jab through the rubber insulating caps now commonly found on plug connectors. If the plugs lack insulators, you just leave the cap on the needle and hold it against the terminal to watch the fireworks.

What you see. You don't have to take a plug out to use a tester, nor are any wires or batteries required. Just bring the indicator against the plug terminal or near the high-voltage leads while the engine is running or being cranked and it will start

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flashing its story of what is going on inside. A healthy plug and ignition system show up as nicely spaced red flashes. If yours are resistor plugs, the flashes won't be quite so bright, but they'll still be steady and even.

An indicator also gives out a pretty glow just from being in the vicinity of a high-voltage ignition system. This is important because spark-plug trouble may not come from plugs at all, but from a break in the wire insulation, chafing where the wire passes under a retaining clip, or a short to the spark-plug cover if the car has one. By passing the tip of the indicator along each wire from plug to distributor cap, you can sneak up on these little performance stealers. A sure clue is a bright flash that stands out against the dull glow you get elsewhere along the wire. Obviously, a new wire is cheaper than a new plug, and it cures the trouble.

Checking an oil burner. As a sidelight to this, my oil burner (furnace, not car) had been erratic about igniting. I ran the tester along the wires leading from the high-voltage transformer to the terminals of the ignition points which touch off the

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oil. Sure enough, a very bright glow picked out a cracked wire. This had been vibrating enough to snuggle over against the housing and short out the burner ignition now and then. A new wire saved a call to a serviceman.

An item you'll want to check occasionally is the possibility of induced firing. This results from the plug wires being grapevined around each other too closely. You may get intermittent engine roughness because induced firing can touch off a cylinder before the correct time. Your indicator will show the trouble by extra flashes in between the main firing shots.

Hunting bad plugs. Maybe your car has been acting up as mine did some time ago. Ordinarily, she'd run smooth. Then I'd tramp on it a bit for a hill and a ragged miss and buck would crop up. You can hunt all day for this deceptive sort of trouble if you do your checking at idle speeds. The problem usually results from the high engine load that boosts the dielectric across the plug gap and causes some weakness in one or two plugs to show up even though the plugs appear good at idle loads.

My tester didn't pick out the two bum plugs at idle. So I pulled the wires off four alternate cylinders and gunned the engine. One bad plug showed up right away. I had to swap wires and try the other four to spot the second. The four dead cylinders were just a way of simulating a load on the engine. (Never prolong this test. It can dump a lot of raw fuel on the cylinder walls and destroy the oil film.)

Signs of bad points. You may find, however, that the trouble seems to show up over the entire set of plugs. If the flashes are regular, but of uneven intensity, it's time to have a go at your distributor points. Maybe just careful filing and regapping will solve your problem. Even if it does, count on getting some new points pretty soon. Other general troubles with the same symptoms are, in order of increasing meanness, corroded rotor tip and cap electrodes, cracked or oil-and-dust-shorted distributor cap, and finally, a sick condenser or coil.

The last two are less common than replacement coil and condenser sales might suggest. If you need 'em, you need 'em bad. But first make a mighty thorough check for shorts in primary connections, bum grounds, bad connections and terminals and oil-film shorting.

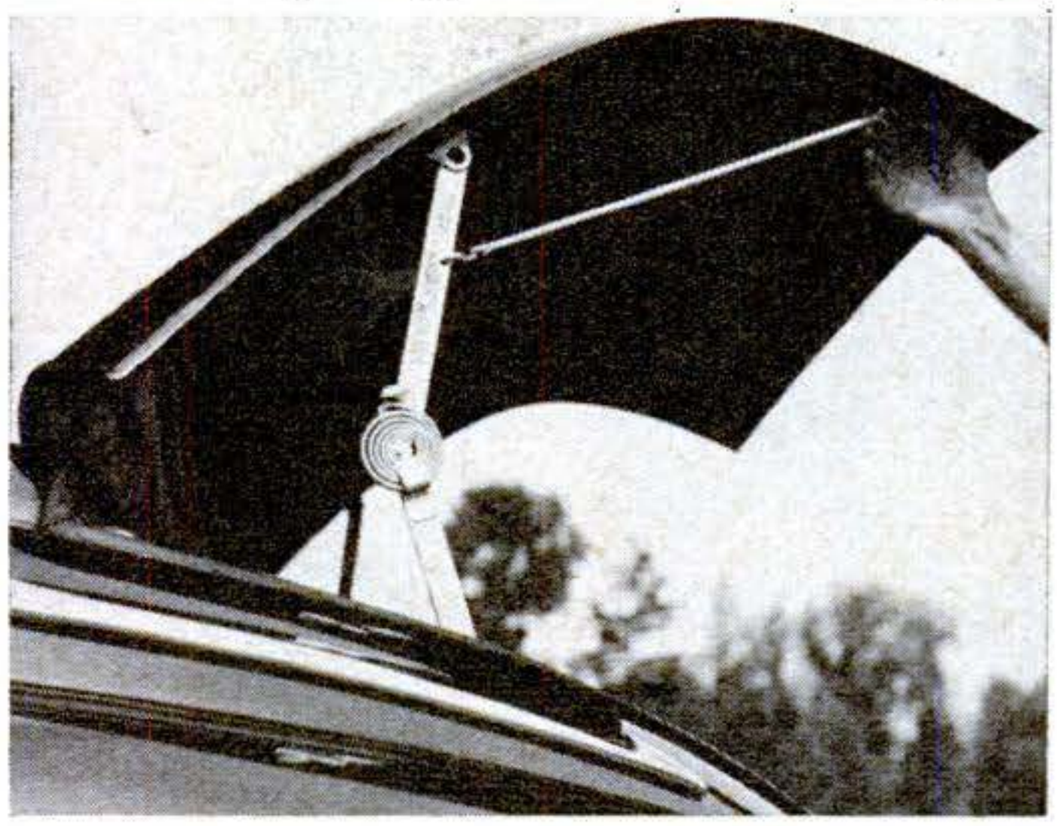
Spotting a fouled plug. An easy trouble to spot with a tester is plug fouling. Instructions with my tester describe the symptoms as "weak flashing, becoming intermittent when speed is increased." On a hunch, I tried this on my power mower. They were right; the plug in the little two-cycle was coked a bit.

The tester can also be used on a balky outboard. It has a pocket clip and doesn't take much room even on a fishing trip. But remember that in a shaded garage under a car hood the tester flashes are brilliant; in bright sunshine, they are less so.

If you play around with a distributor, you should retime the spark. The makers never intended a spark-plug tester to be used as a timing light. But running a spare length of high-tension wire from No. 1 plug to the tip of the indicator will turn it into a fair excuse for a timing light if the garage is quite dark and you hold the flasher close to the timing marks. END

The man on the job
Whose work gives most pride,
Is the one who at home
Has a hobby to ride.

Added Spring Holds Trunk Open



THE springs that hold open the trunk lid of a car may weaken enough to let the lid drop without warning. If they are spiral springs, operating around the hinged joint of a folding brace, adding a screen-door coil spring will make the lid safer.

S-shaped connectors in each end of the spring are dropped in ¼" holes drilled in the upper arm of the brace and the metal lining of the lid.—*O. A. Nelson, Seattle.*

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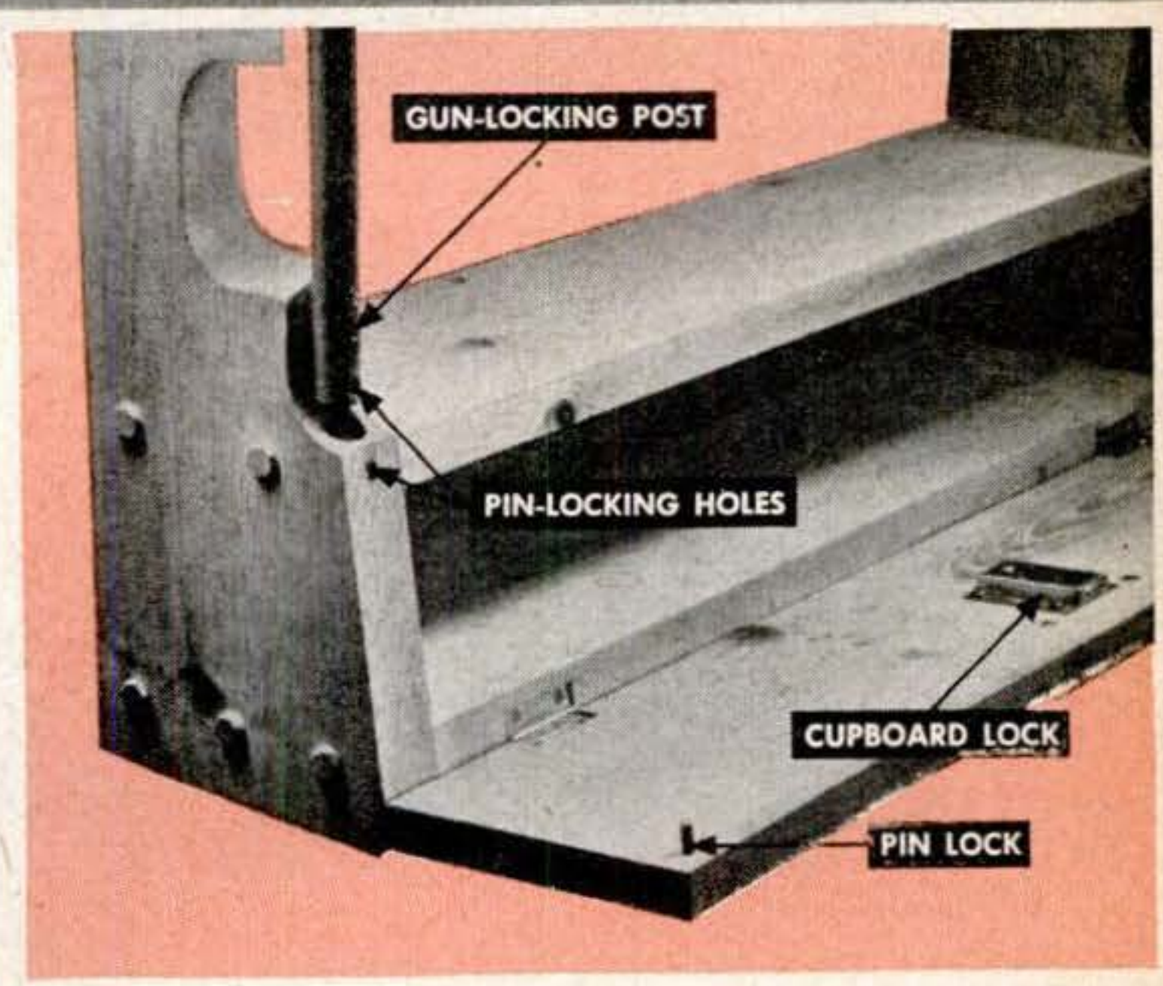
FOUR GUNS, ammo, cleaning gear are kept safely in good-looking rack. Guns are locked in by front posts held down by pins in cupboard door (right).



By Glenn A. Wagner

A Gun Rack You Can Lock

Here's a way to keep your guns on display—without taking chances.

A WALL rack is a convenient—and attractive—place to keep your firearms. This one provides the extra advantage of safety. Turn one key and all four guns plus the ammunition cupboard are locked tight. The key locks the cupboard door, and the closed door locks sliding posts that prevent removal of the guns.

You'll need about 6′ of 1¼″-by-6″ stock, 8′ of ¾″-by-6″, plus some ⅝″, ½″ and 3/16″ dowel, to build this kind of rack. Knotty pine was used here, but any attractively grained wood will serve just as well.

Please turn the page for step-by-step photographs showing how to construct the rack.

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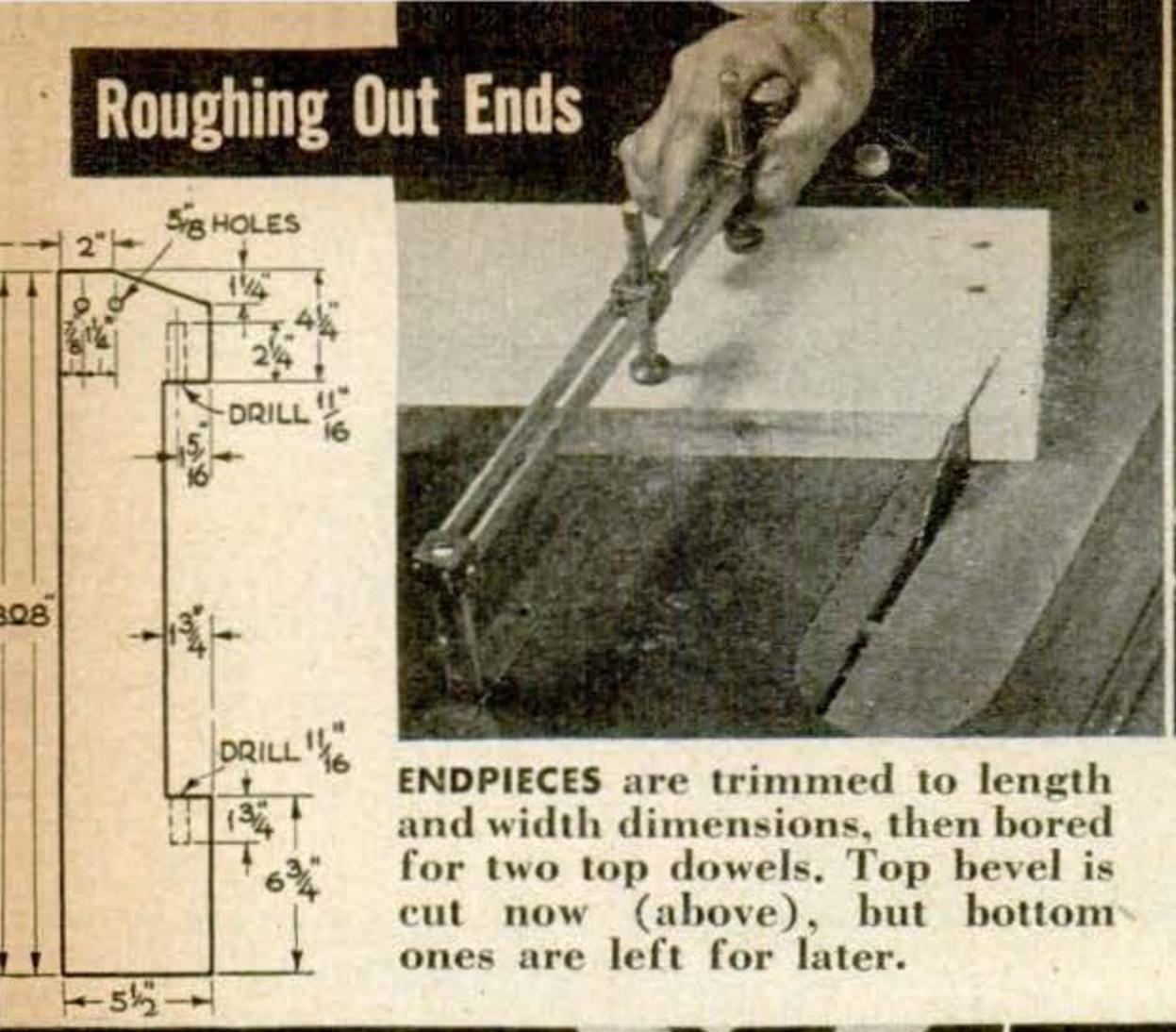
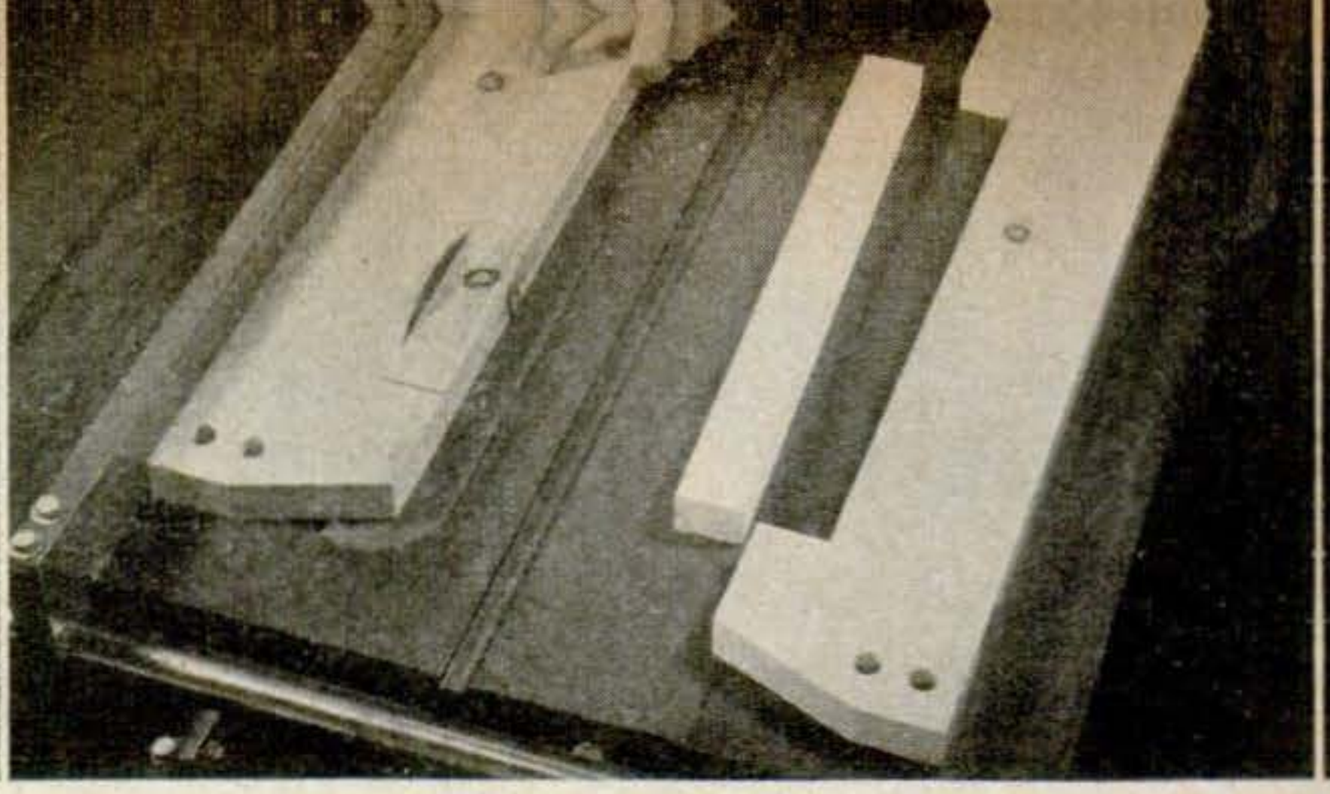
Roughing Out Ends

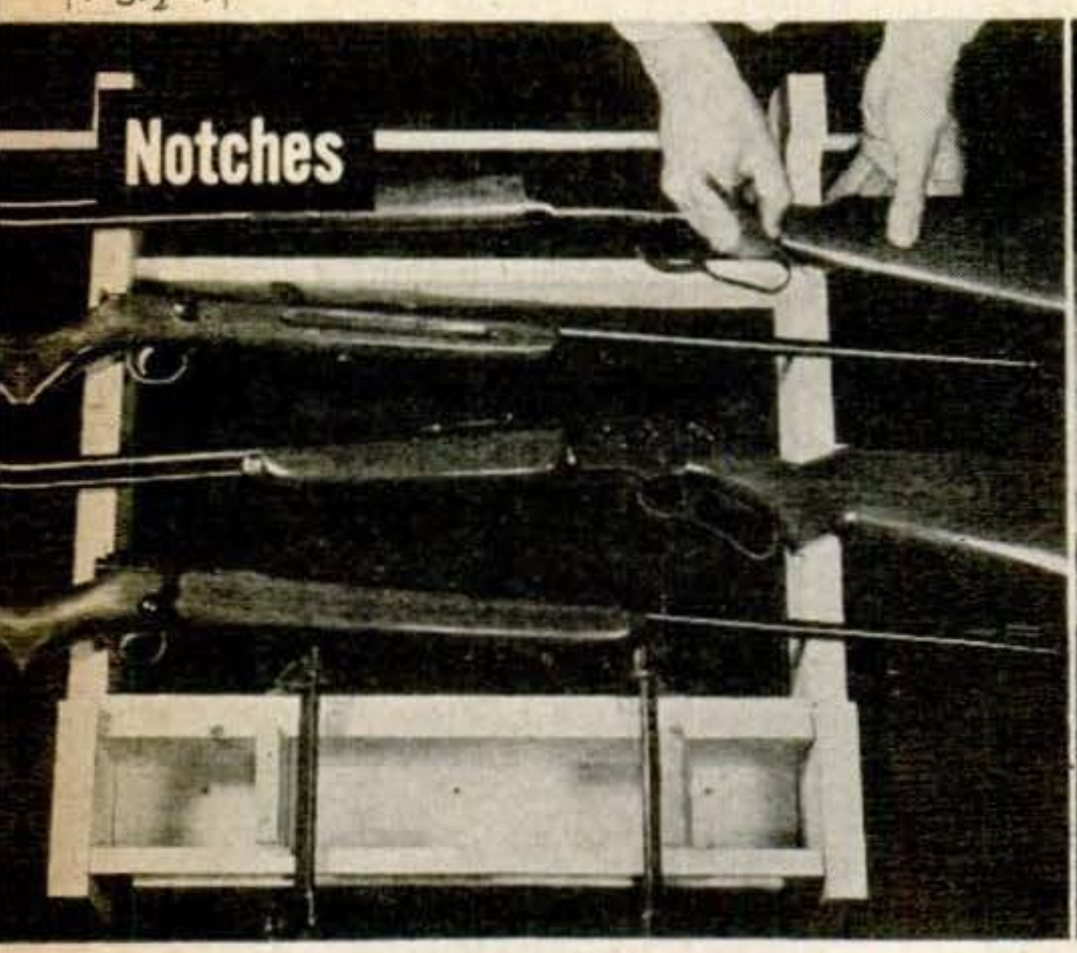


ENDPIECES are trimmed to length and width dimensions, then bored for two top dowels. Top bevel is cut now (above), but bottom ones are left for later.

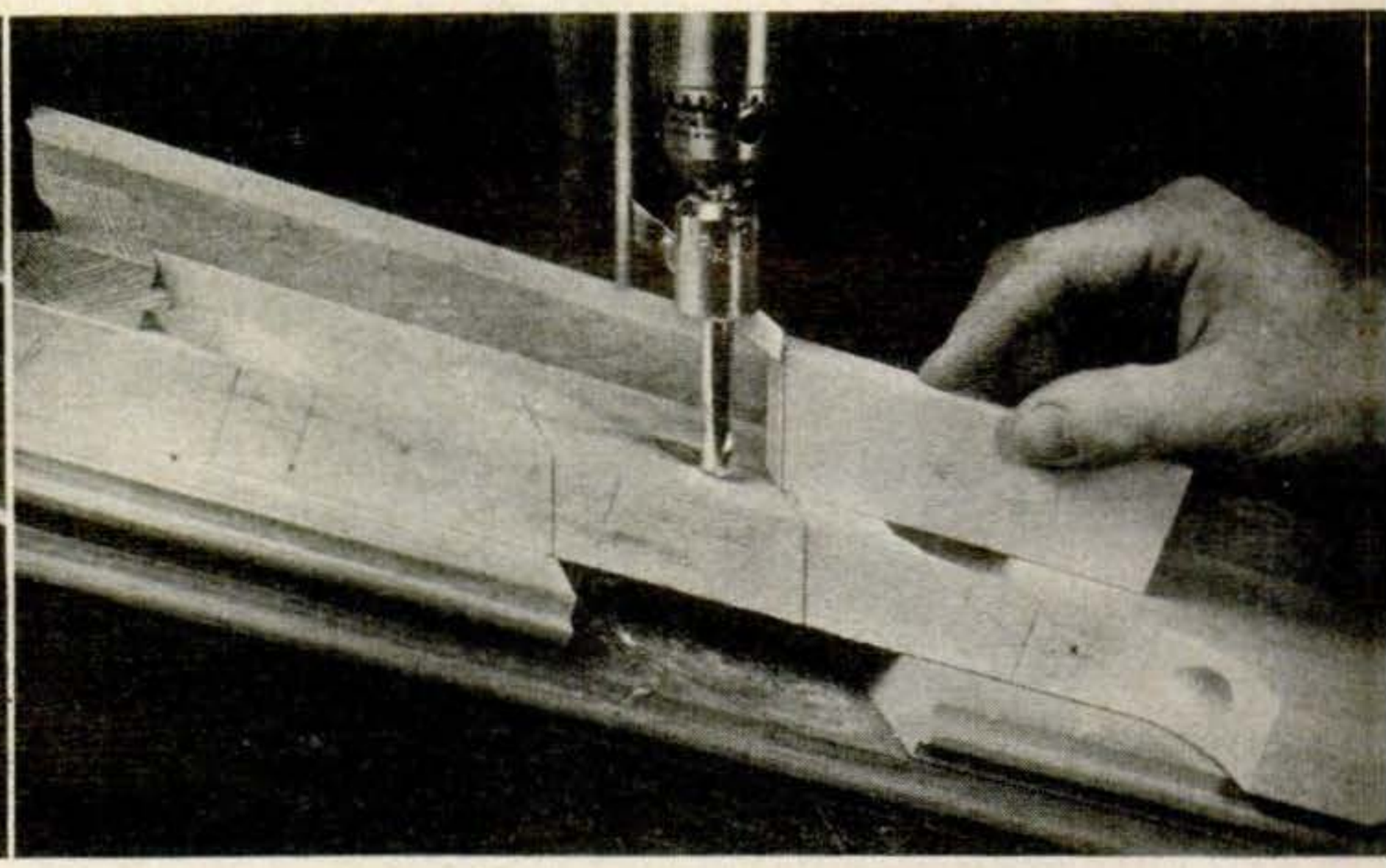


CUT 1¾"-by-17" notch in front edge of each endpiece. Lengthwise cut is made by laying work over saw blade, raising blade from below, then feeding work forward. Marks on saw-table insert show saw-teeth limits.

Notches

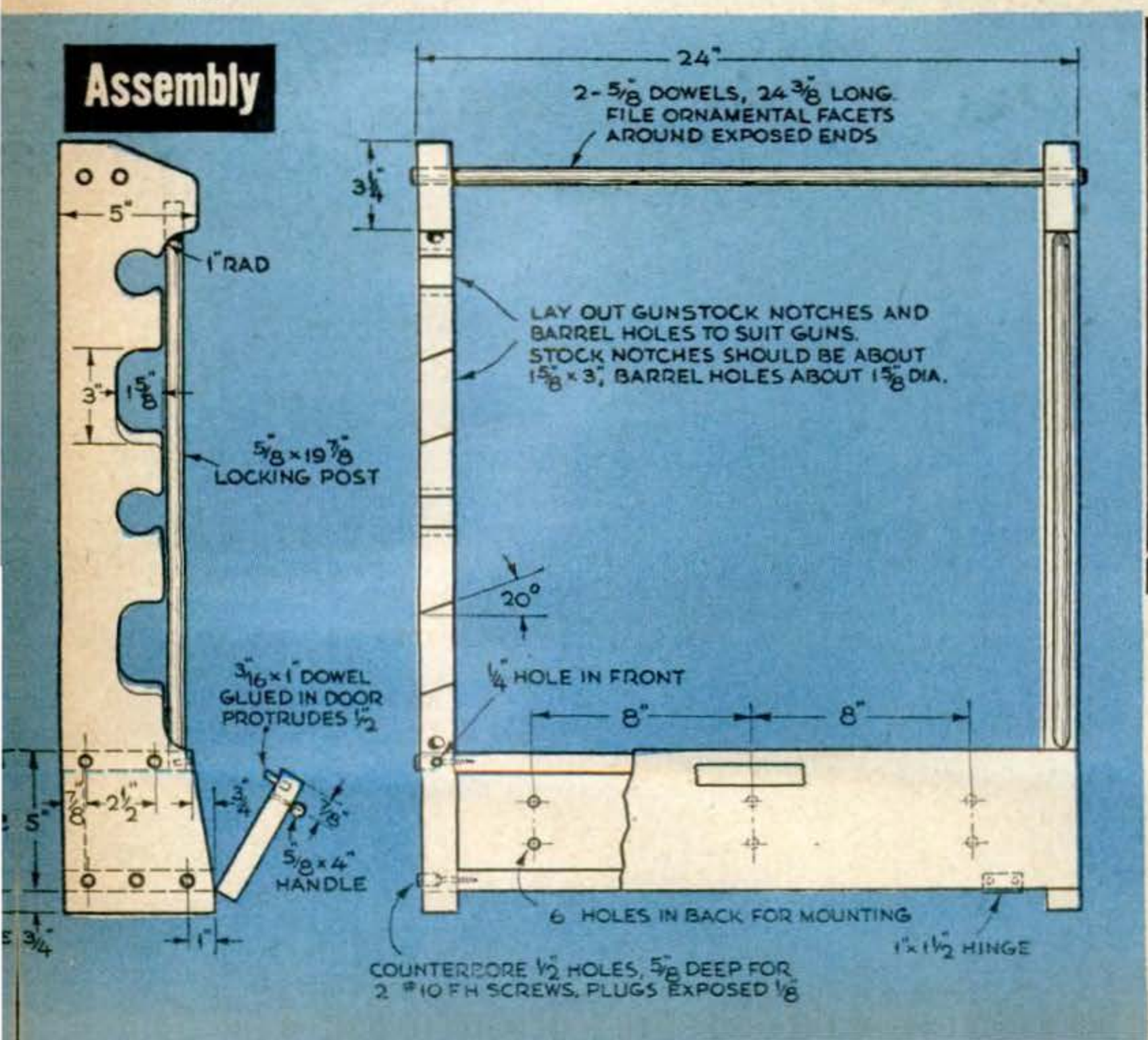


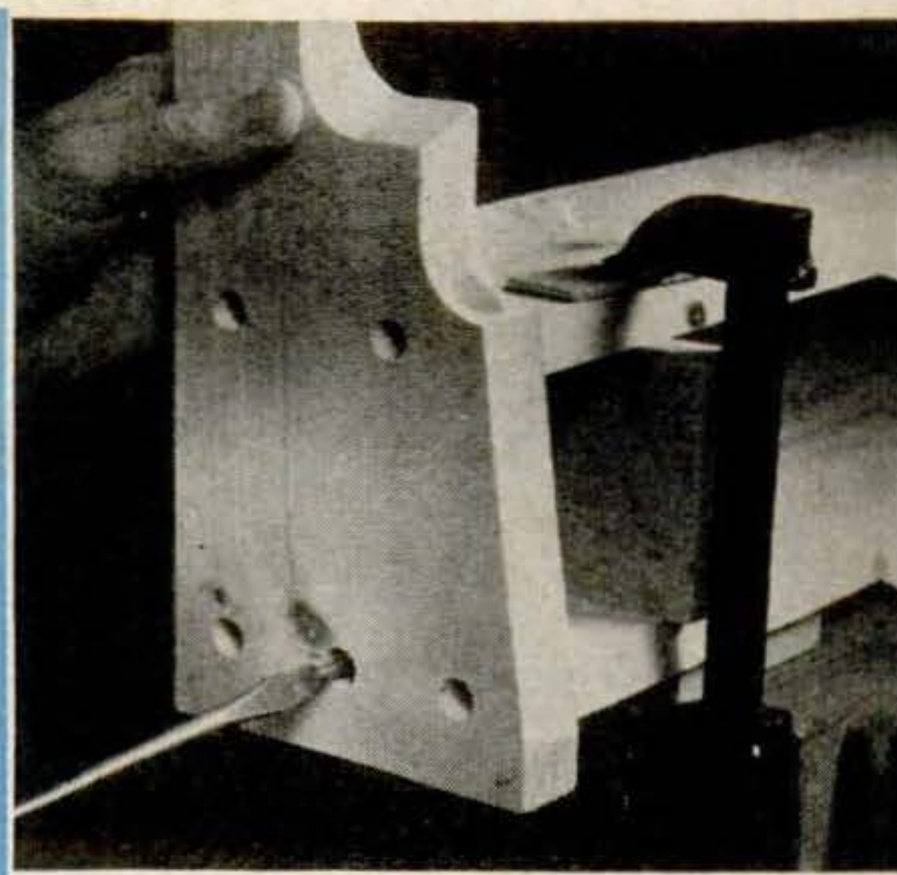
ASSEMBLE RACK temporarily, lay guns on it to mark for stock and barrel notches. Cupboard top, bottom and back, held by clamps, can now be assembled with glue and 1½" No. 10 flathead screws.



START NOTCHES with drill-press hole cutter set for 1⅝", lining up cutter tip with limit of hole marked on stock (above). Cut holes from both sides. For elongated notches, cut both holes halfway before turning stock.

Assembly





HOLES for 2" No. 10 flathead screws are drilled in endpieces and counterbored ⅝" for dowel plugs that will hide screws. Then glue and screw endpieces to ammunition cupboard. Note clamp and block used to keep shelves parallel.

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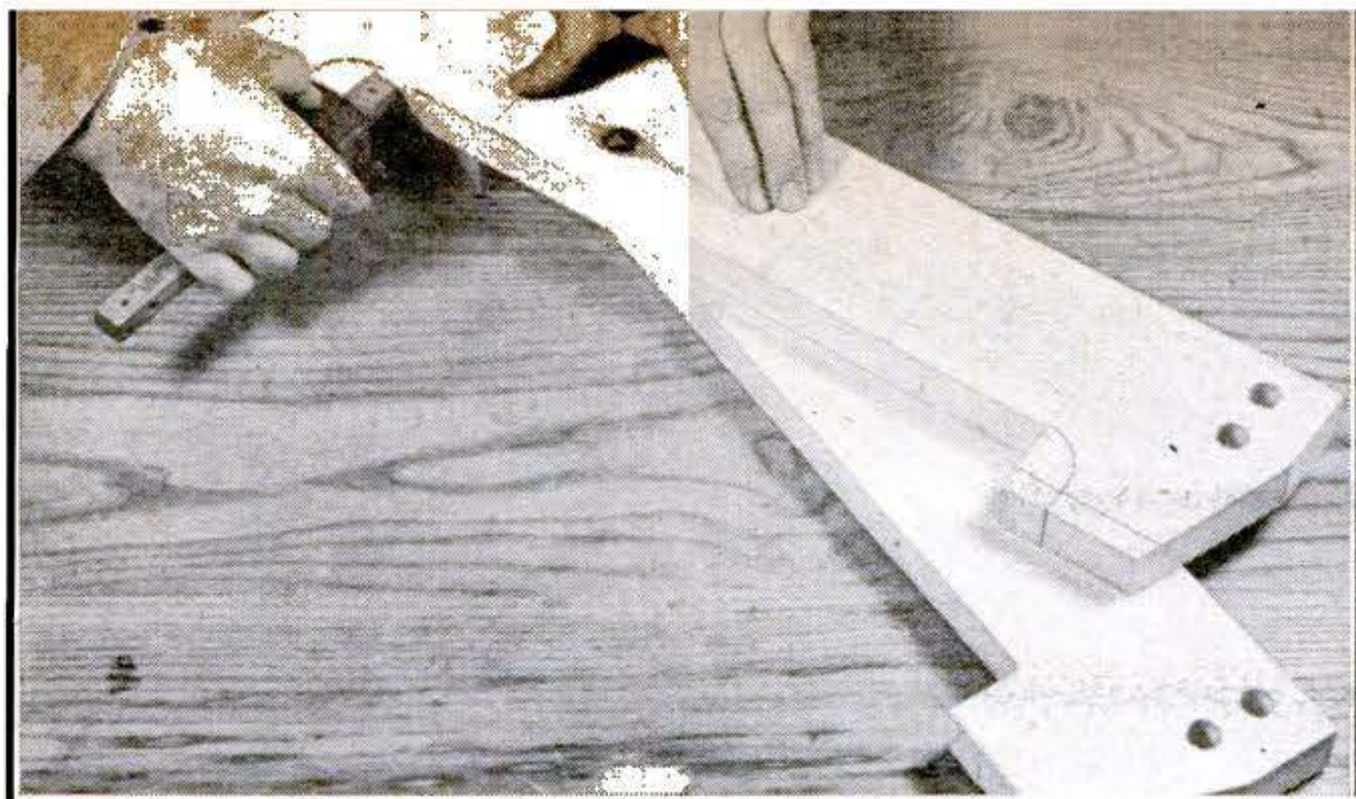
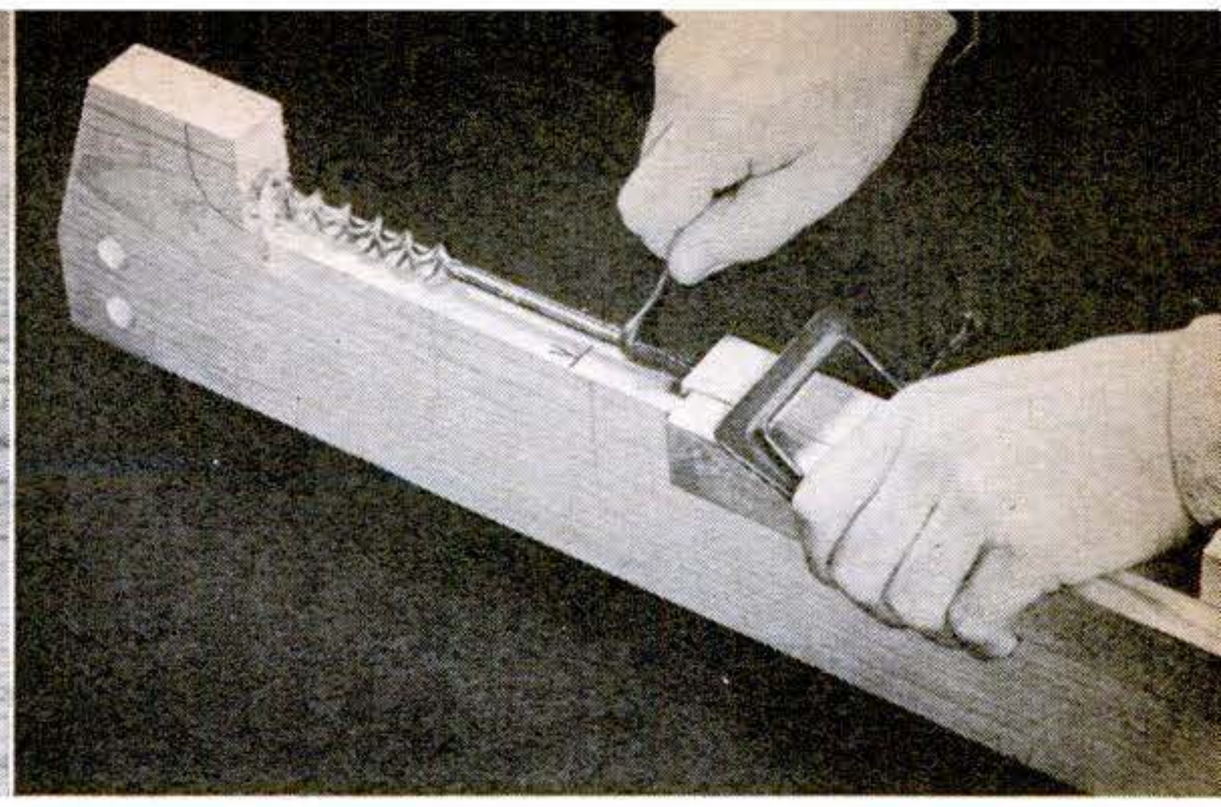
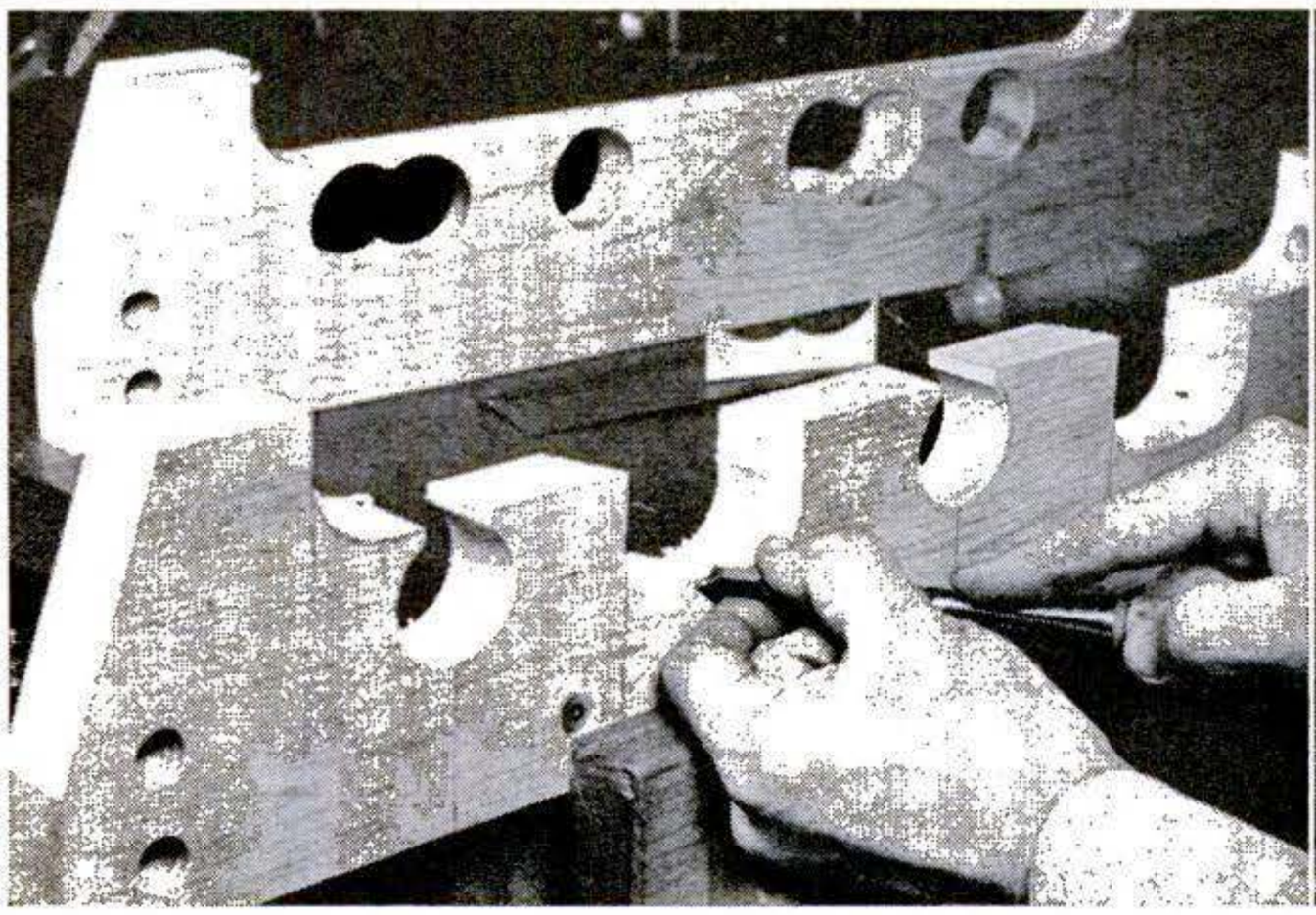


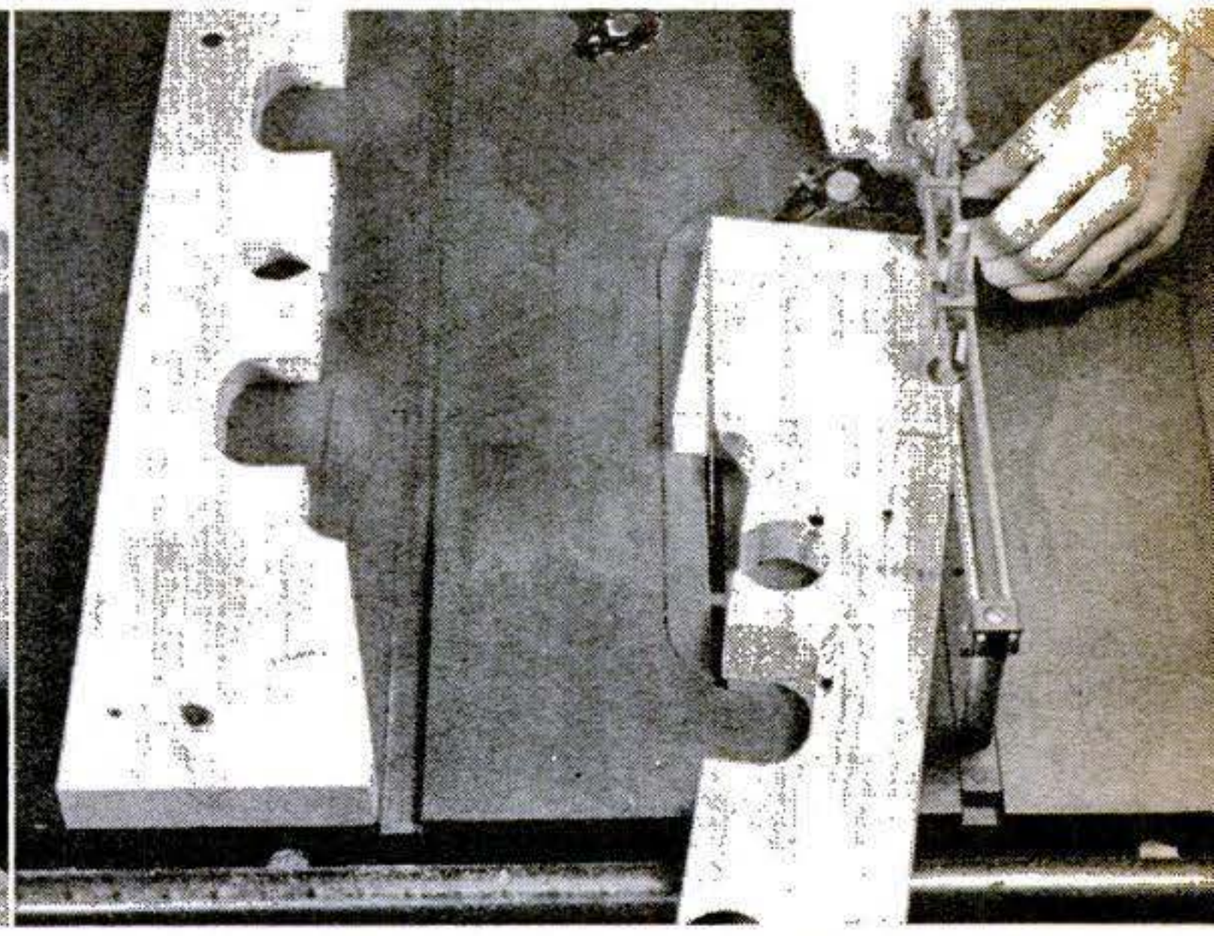
MARK the radius cuts on the notches and the final width of the tops, but do *not* make cuts until holes for locking posts are bored. Scribe lines and lay out centers for these holes with marking gauge set at 1 5/16".



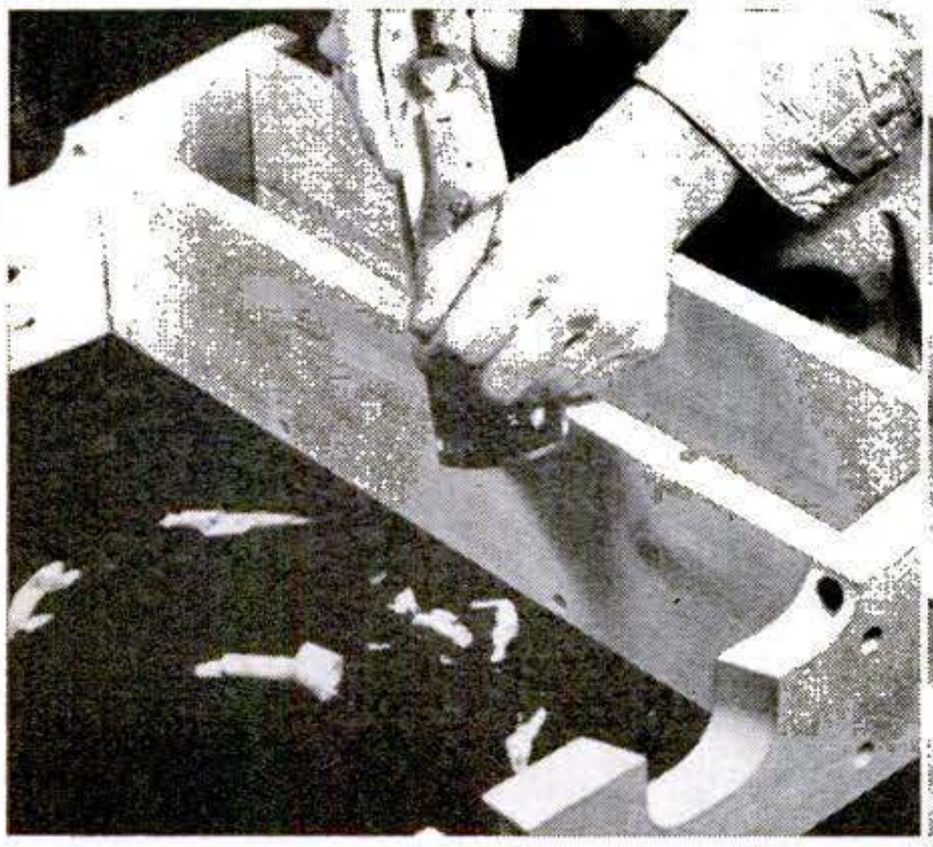
BORE locking-post holes with 11/16" bit turned by wrench. Two pieces of wood act as follow block, top block having dimple for tang. After bit takes first shaving, mark depth of cut on edge as stop guide for follow block.



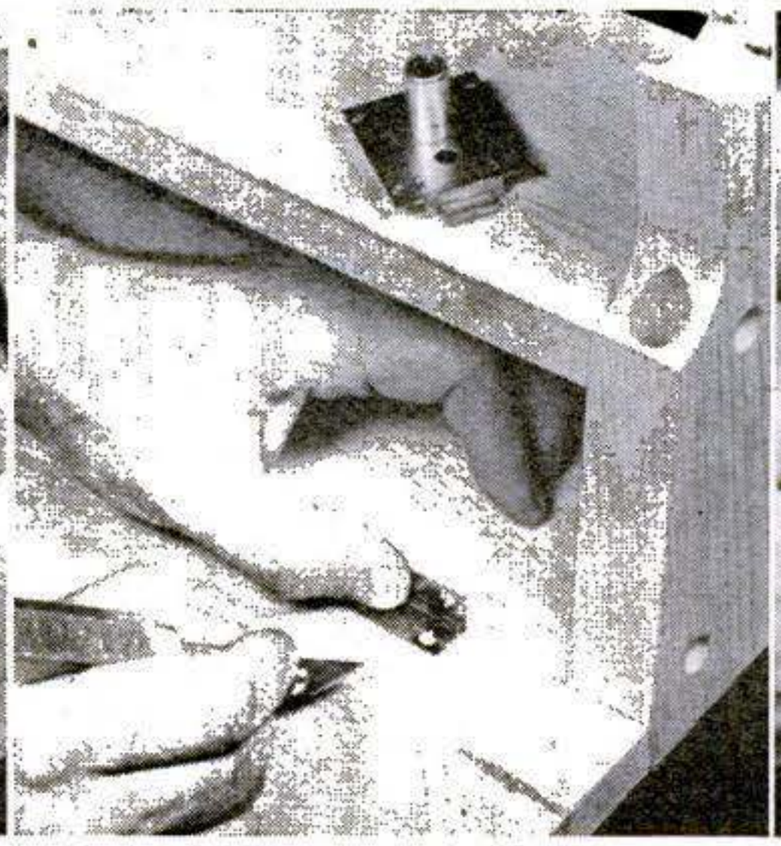
FINE-TOOTH SAW opens holes out to edge of endpieces, also removes waste at back of elongated stock notches. Use sharp chisel to clean up, taking skew cuts and working from both sides. Drum sander smooths notches.



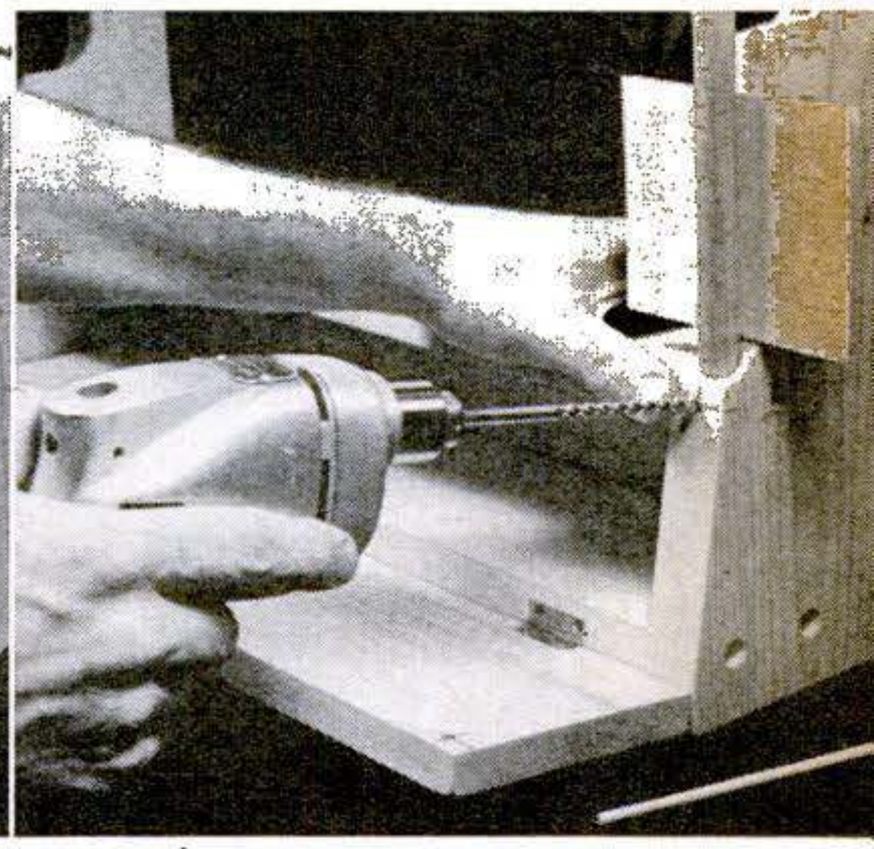
TOPS OF ENDPIECES can now be cut to 5" width, and bottom front edges can be beveled. Beveling operation is left until last in case placement of locking-post holes requires some adjustment. Holes should be 3/16" from bevels.



EDGES of cupboard shelves are beveled with plane to match bevel on endpieces. Check work frequently with straightedge. After edges are sanded, door is cut and fitted so that it overlaps the ends. Dowels at top of rack are glued in place.



LOCATE HINGES—1"-by-1¼" brass—and scribe length of gains with knife. Mark gain width with marking gauge. Fit hinges so center of pin is in line with matching corners. Mount lock and cut bolt notch so door locks snugly.



INSERT LOCKING POSTS and drill ¼" holes for the pin locks—holes do not go through posts. Drill 3/16" holes in the door for the pin locks, which are 3/16" dowels that protrude ½" from door. Add door handle and finish. END

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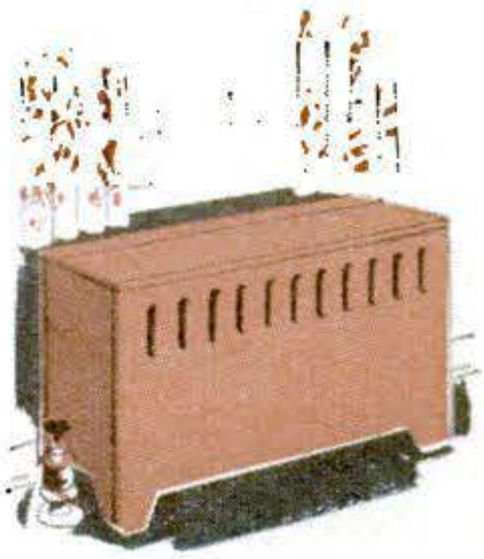
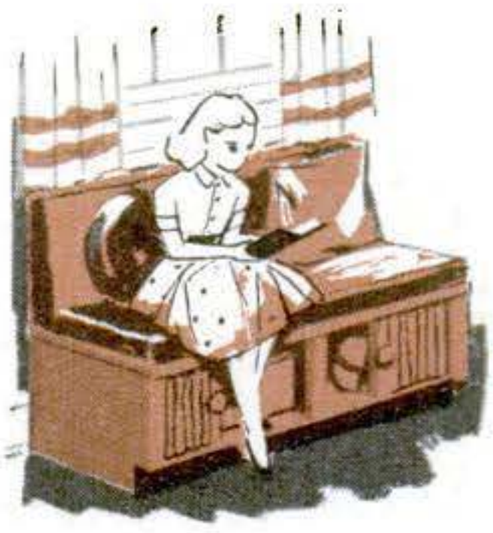
You Can Use Hardboards All Through

A VALANCE scroll-sawed from ⅛" standard hardboard will trim a problem window.



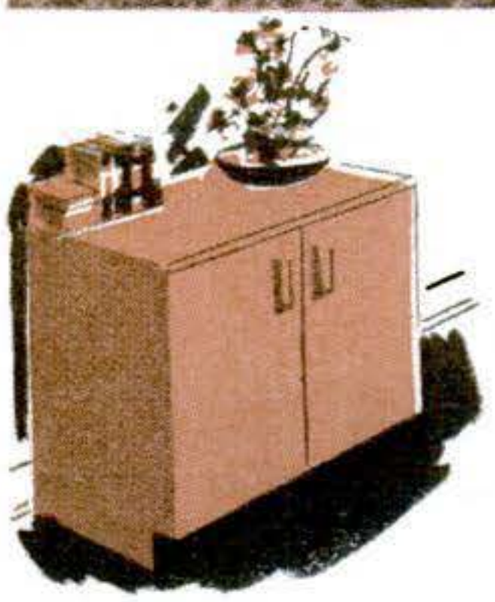
A RADIATOR can be hidden by covering a two-by-two frame with 3/16" or ¼" standard hardboard.



A WINDOW SEAT can be topped with ¼" hardboard. Frame with two-by-twos, cross supports 16" o.c.

CARD TABLE is enlarged with half disks of tempered stock. Fasten so each one covers half of top.

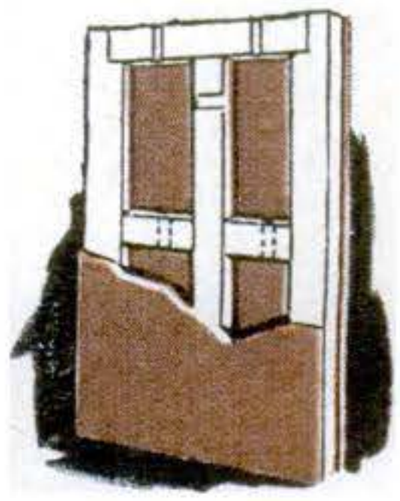
IN THE LIVING ROOM



FOR A NEW DRESSER, or cabinets, be sure to use tempered hardboard. This stands up best to dampness.

A HEADBOARD made of common hardboard and wood framing is an easy-to-make project.

A WASTEBASKET of *patterned* hardboard is a job for your next idle evening. You can bend it also.



BUILD A DOOR too, if you add a closet. Cover with tempered hardboard. Drill vents in frame.

BEDROOM

Hardboards: Substitute for Wood

Learn how to pick man-made panels for the job at hand and you'll keep money in the bank.

By Paul Corey

WHEN you set out to build something for your home—a cupboard, a radiator cover, a new door—you don't have to rely entirely on wood or plywood. You can often use hardboards and save money.

Hardboards come in two general grades—standard and tempered. Standard hardboard is made from wood chips or wood refuse reduced to a mass of fibers, then heated and pressed into panels. Tempered is made by adding a special compound to the fiber mass and baking the panels to make them stronger and less likely to absorb moisture.

When you go to a lumberyard or supply

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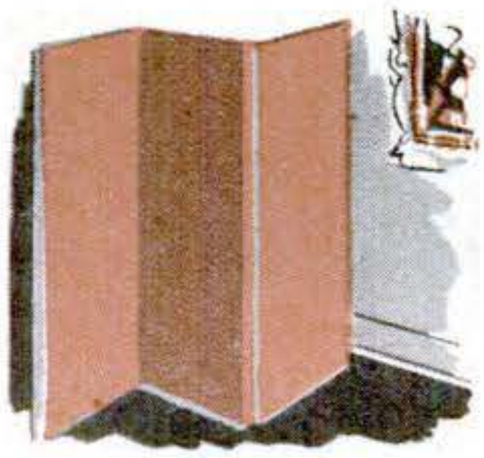
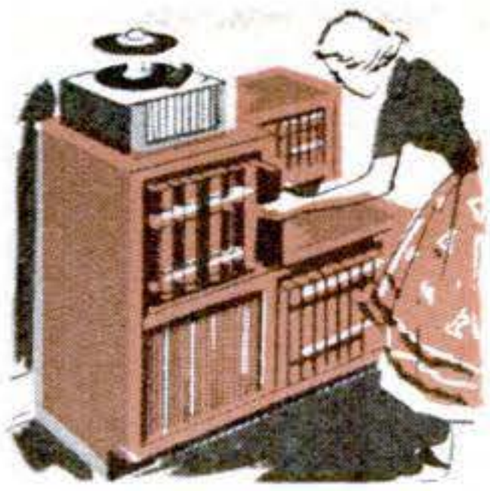
the House



FOR A SCREEN, glue and brad ⅛″ tempered stock to one-by-twos. Join with brass hinges.

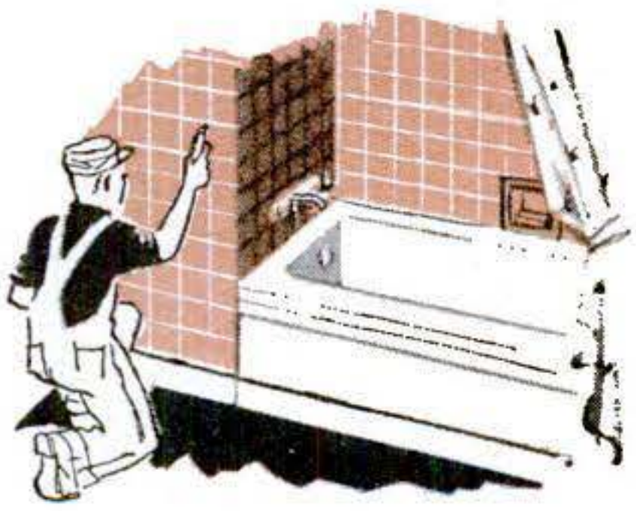


A RECORD CABINET for extra albums is quick job. Use ¼″ hardboard on two-by-twos.

FILE for small items can be placed on a door by tacking hardwood strips across upright wood dividers.

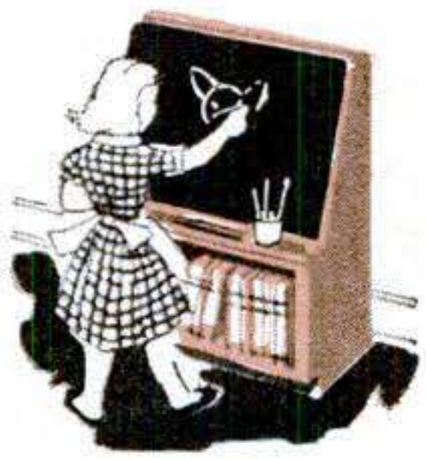
VEGETABLE BIN will please the housewife. Use two-by-two corner uprights, one-by two cross supports.

KITCHEN

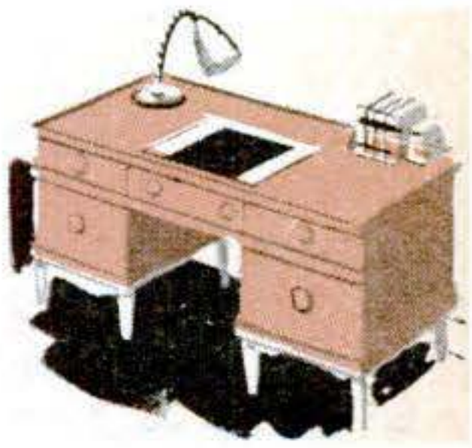


TILEBOARD gives the appearance of the real thing. Special striping tool brings out tile effect.

BAR COUNTER can be made of tempered hardboard. Large sheets are available for unbroken runs.



CHALK-BOARD PAINT is now available. Apply it to tempered hardboard — and everyone will have fun.



BUILD A DESK, using ¼″ standard hardboard for the top, sides and drawers. Trim with wood.

BATHROOM BASEMENT JUNIOR'S ROOM

house, brand names may confuse you a bit. But they shouldn't. For your purposes a hardboard is a hardboard no matter what the brand name. Presdwood, Weldwood Hardboard, Weatherwood Duron, Forest Hardboard, Allwood and Temwood all come in standard and tempered grades.

Sizes. Hardboards range in thickness from ¼″ to 5/16″ and the panel sizes from 3′ by 4′ to 4′ by 12′ and 4′ by 16′. Presdwood and Temwood offer a thickness of 5/16″, 1/16″ more than the others. And you can get Weldwood Hardboard and Forest Hardboard in 4′-by-16′ panels if your dealer happens to stock them.

One of the newer hardboard shapes, called Tee-N-Gee, comes in 8′ panels 16″ wide. Made of ¼″ standard hardboard, these have tongue and groove on respective edges.

Standard hardboards are suitable for use indoors where it is dry, and where the surface won't have to take too much of a beating. The tempered type can be used outdoors, and the harder surfaces will stand rough use. Many hardboards have only one smooth side, but Weatherwood Duron and Masonite Duolux are smooth both sides.

Prices range from 10 cents a square foot for ⅛″ standard grade to 22 cents for ¼″ tempered. Tileboard and patterned hardboard run somewhat higher.

How to work them. Made entirely of

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wood. hardboards can be worked with the usual woodworking tools. Either handsaws or power saws will cut them.

A power saw will sometimes shoot sparks when you cut the tempered type but that's nothing serious. To prevent scratches on the surface that will be exposed, keep it up while sawing. This will also give a sharper finished edge.

Hardboard edges have to be protected. If exposed, beveling with a plane or rounding with sandpaper will take care of that.

It is possible to use small panels as sliding doors in cabinets or as drawer and shelf partitions without framing, and not get into trouble. But usually hardboard is supported on a frame. The size of this framing material depends upon the project. It should range from 1″ by 1″ and 1″ by 2″ for small cupboards, cabinets, etc., to 2″ by 2″ and 2″ by 4″ for garage doors or closet walls.

All hardboard joints must be supported by a continuous frame. Nails, screws, bolts or glue can be used to fasten the hardboard to supporting material. If finishing nails are used, the heads can be set and the holes filled. No method of fastening should come within ¼″ to ⅜″ from the edge, and nails and screws should not be placed more than 4″ apart. If you plan to use a large panel, always begin the nailing in the center and do the edges last.

His take-off reminded them of a jet,
They said, when last he was seen.
But he left behind the motor parts
He was scrubbing with gasoline!

You can't use hardboard for a nail or screw base. Hardboards won't take toe-nailing and you can't nail into the edges.

Bending hardboards. You can't make fancy bends with hardboard, but it will take simple, one-direction curves. If the curve is to be supported, the bend can be made dry. Start at one end and fasten the panel permanently as you wrap it around the form.

For unsupported bends hardboard has to be dampened. Scrub water into the back of the panels. If several panels are used, place them in pairs, back to back with wet newspaper between. If the job calls for only one panel, then cover it with wet newspapers or cloth. Let dampened panels stand—24 hours for standard, 72 for tileboard and patterned hardboards.

After the panels have become evenly damp, fasten them to the shaping form. Let them dry thoroughly before removing the form. The radius of the shaping form for an unsupported bend should be slightly less than the curve when finished. This will allow for a small amount of spring-back when the panel is removed from the form.

Uses outdoors. The tempered grades can be used where the surfaces will be exposed to the weather. But before the panels are put on they should be dampened as for moist bending. This will prevent swelling and buckling later from moisture.

BENDING HARDBOARD

The minimum bend you can figure for hardboard for thickness and grade:

Standard	⅛″	3/16″	¼″	5/16″
Minimum bending radii for cold dry bend, smooth side out	12″	18″	26″	40″
smooth side in	10″	12″	22″	28″
for cold moist bend, smooth side out	8″	12″	18″	28″
smooth side in	4″	6″	14″	16″
Tempered				
Minimum bending radii for cold dry bend, smooth side out	9″	13″	24″	36″
smooth side in	6″	10″	18″	24″
for cold moist bend, smooth side out	4″	8″	16″	24″
smooth side in	3½″	5½″	10″	14″
Patterned hardboard	⅛″			
Minimum bending radii for cold dry bend	14″			
for cold moist bend	10″			

FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE

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Hardboard finishing. The color of hardboard varies from the tan of the standard grade to a rich chocolate brown of the tempered. The Masonite Corp. and Armstrong Cork Co. also sell a tempered board that is black.

The smooth, dense surfaces of hardboards present no special finishing problems. Paint, enamel, lacquer, stain, shellac and varnish can be applied in the usual way.

Special hardboards. Almost all of the hardboard producers make a tileboard. This is a tempered hardboard, ⅛″ thick with one face embossed in 4″-by-4″ tile design. Tileboard can be used to dress up washrooms or on walls behind basement sinks or above counters.

It can be nailed to a frame support like other hardboards or stuck to an old wall surface with tileboard or linoleum cement. After painting the whole surface with enamel, the tile lines are striped in to complete the tile effect.

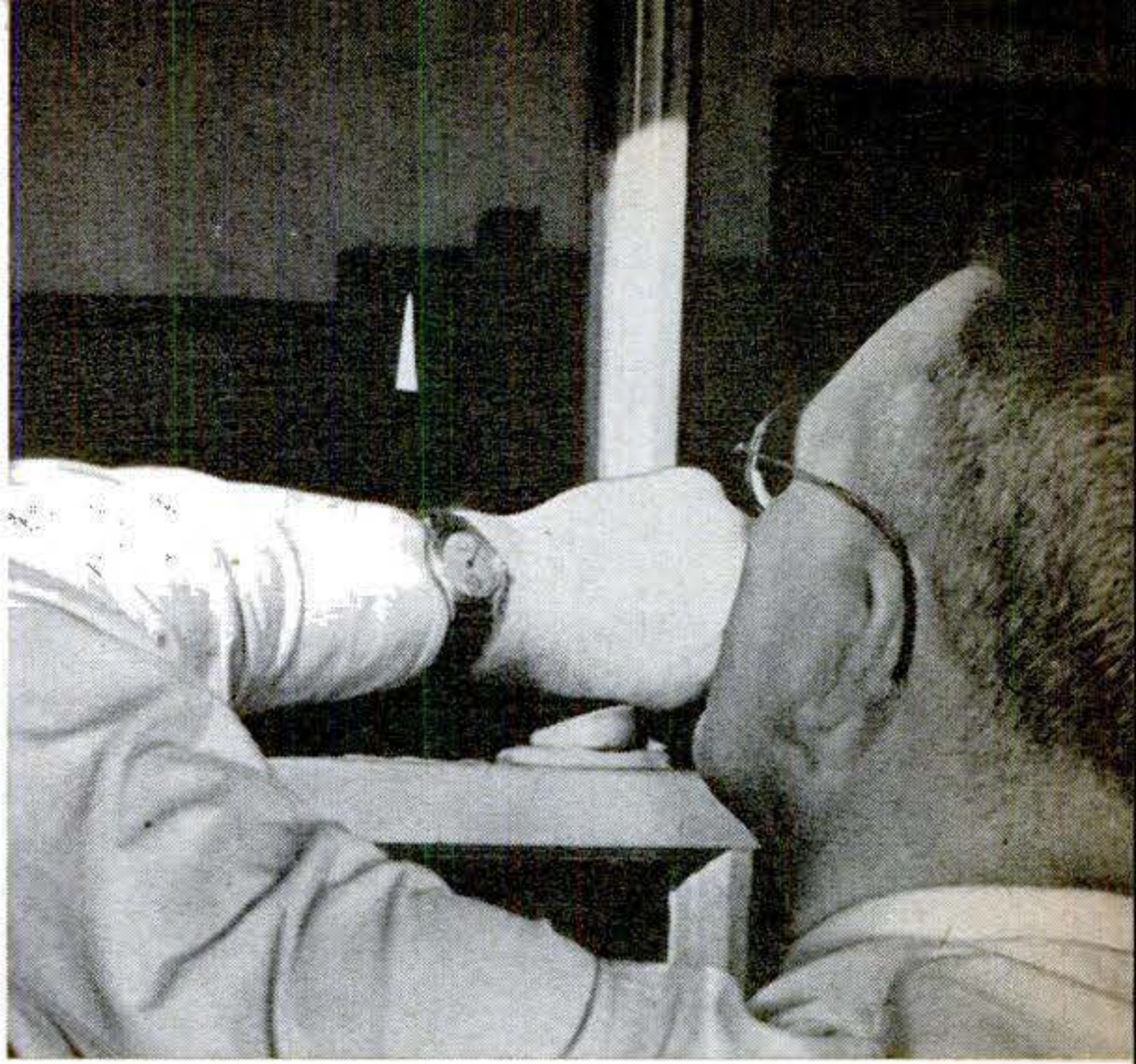
Two companies produce a patterned hardboard which is designed to resemble leather. One is called Leatherwood, the other Patterned Tempered Temwood. This stuff is expensive, but a small amount of it can give a look of attractive richness to home bars, cabinets, counter fronts and dining areas.

The patterned hardboards can be given a clear finish or painted. A tone-on-tone effect can be had by giving the surface a coat of lacquer sealer, then a coat of paint of the desired color. A third coat of glazing liquid with pigment added is applied to the panel, then wiped off. The color remains in the depressions of the pattern, accenting the leathery effect.

Several companies produce a utility hardboard variously called Panelwood, Thriftwood, Structoboard or Temboard. This grade is usually limited to two thicknesses, 3/16″ and ¼″, and a few panel sizes. It is the least dense of the hardboards and is used primarily as an inexpensive wallboard. You can use this utility grade as a substitute for a similar thickness of standard hardboard if you want to.

One other grade of hardboard which you can use as a substitute for standard grade of similar thickness is called "Underlayment." It is sold primarily as a base for linoleum and asphalt tile, but it can be used where standard hardboard of the same thickness is called for. END

Next Month: Edwin M. Love will tell you how to make two boards out of one.



Let the Stars Check Your Watch

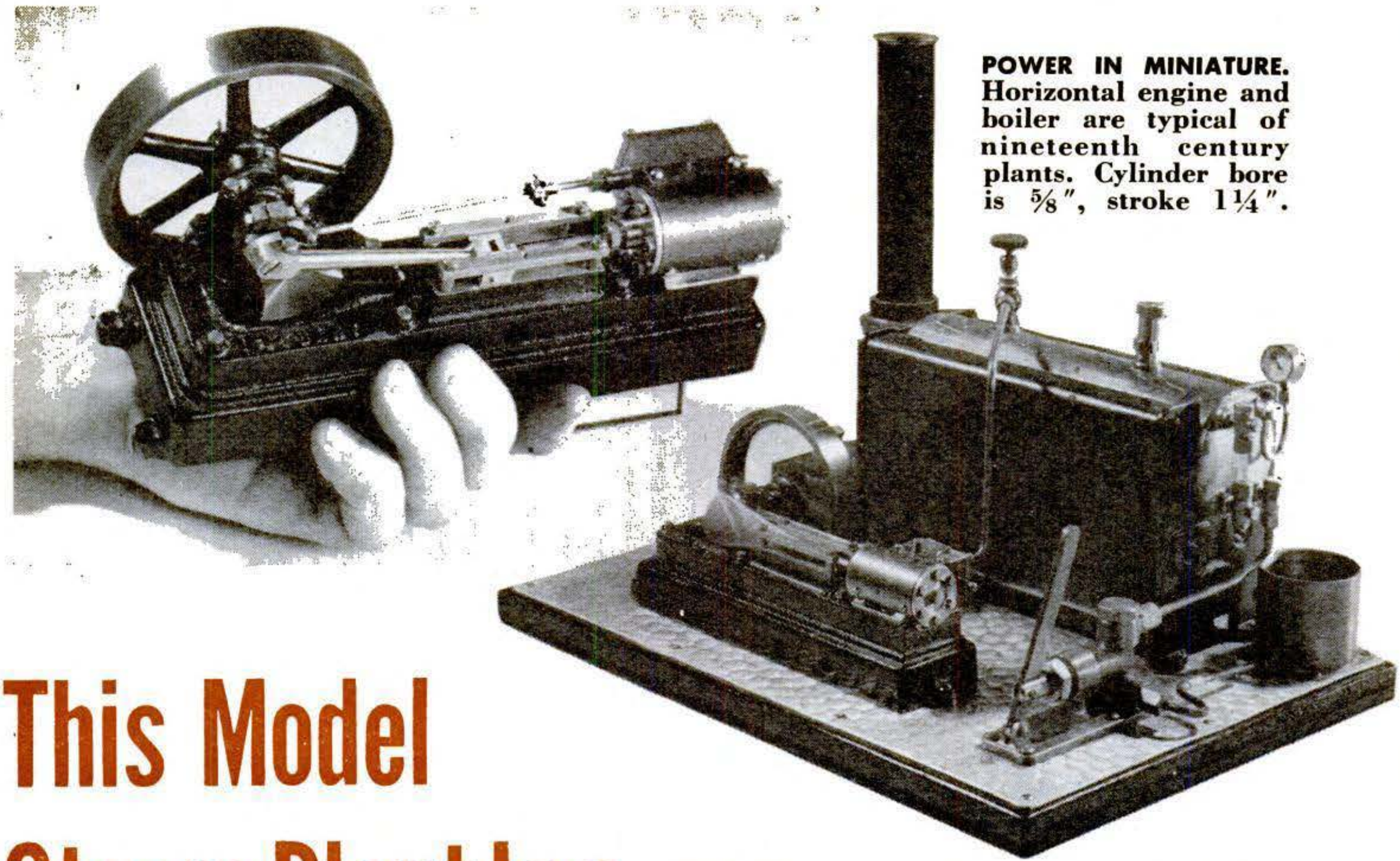
THE world's time is regulated by the stars. You can use a star to determine the accuracy of your own timepiece. Pick a star that you can watch carefully as it sets behind a distant building. Stick a marker of adhesive tape on the window glass so that you can sight the star more accurately. And then on a clear night note the exact time at which the star disappears.

Check again the next night. If the star sets 3 minutes and 56 seconds earlier, your watch is exactly right. If it does not, the watch has gained or lost since the previous night.

Acid Shows Up Phony Money

IS THAT silver coin a counterfeit? The acid test suggested by the U. S. Secret Service will show you. All you need is a solution of 10 grains of silver nitrate and 20 drops of concentrated nitric acid in one ounce of distilled water.

Scrape a spot on the coin and apply a drop of the solution. If the coin is good, its appearance will not change. If it is counterfeit, the acid will blacken it as it did the pieces of lead, tin and zinc shown with the genuine coin below.



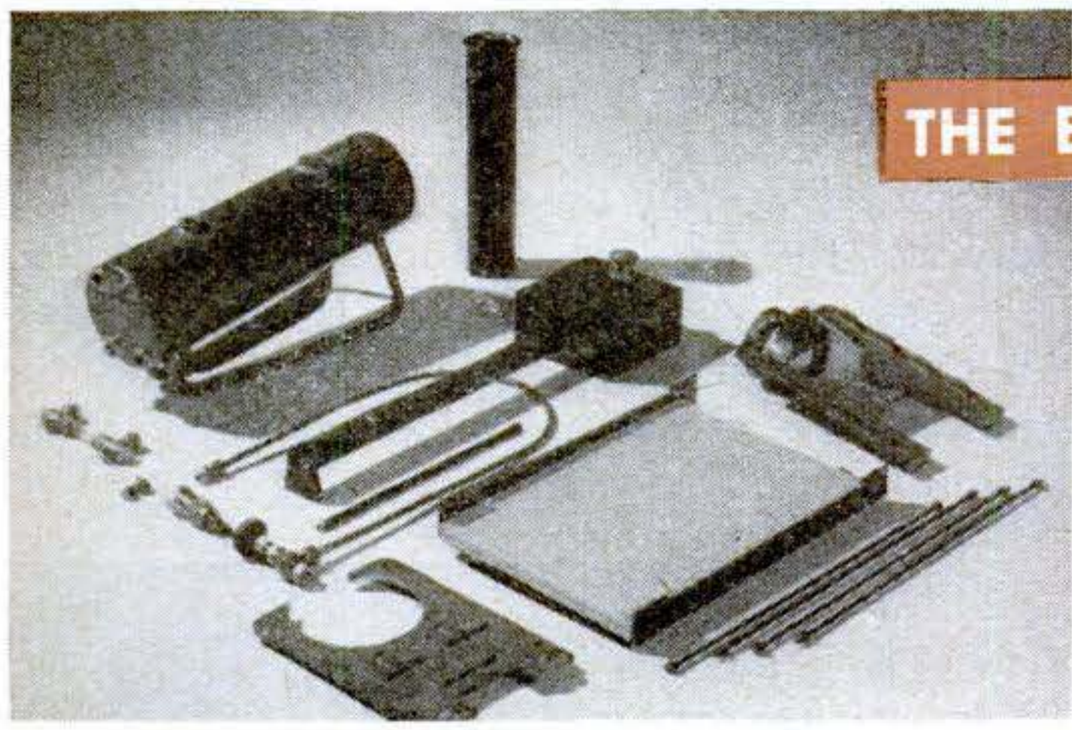
POWER IN MINIATURE. Horizontal engine and boiler are typical of nineteenth century plants. Cylinder bore is 5/8", stroke 1 1/4".

This Model Steam Plant Is a One-Evening Job

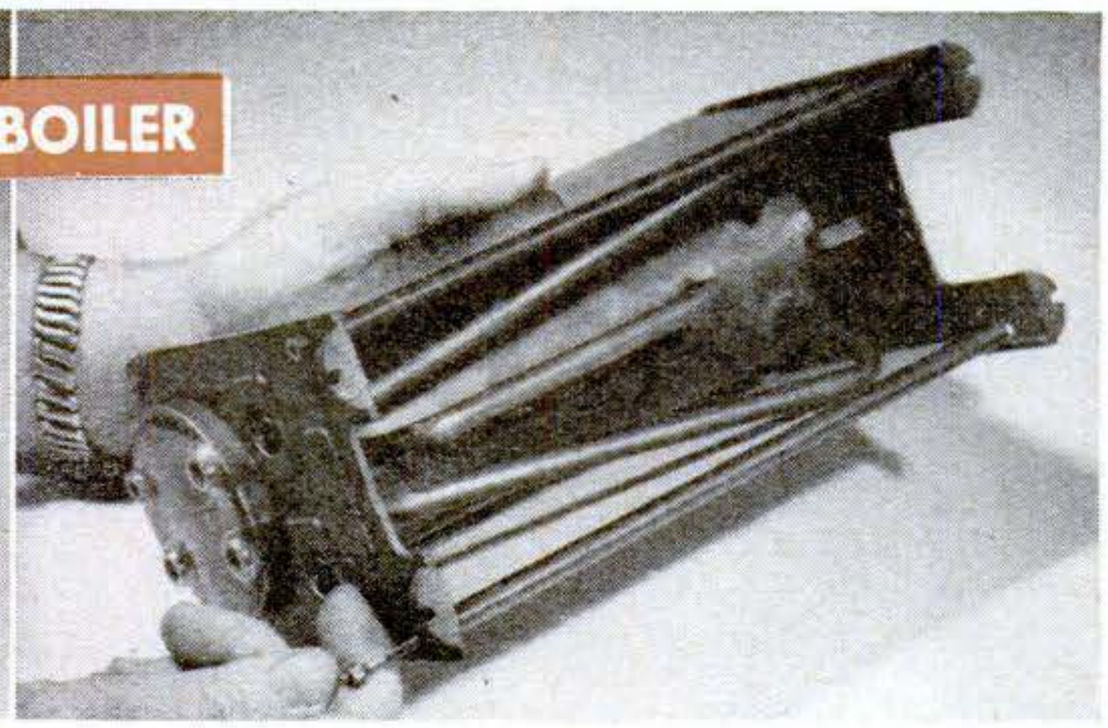
Mill engine and boiler can be assembled from kits with only wrench, pliers and screwdriver.

SOME evening after supper you haul a box of small parts onto the kitchen table and set to work. A little before midnight you put water in the boiler and alcohol in the burner. Five minutes later steam is whispering around a joint or two. You snug them up, crack the throttle and turn the flywheel a few times by hand to get rid of condensation and warm the cylinder.

Open up a bit more and the engine ticks over effortlessly, rod and crosshead gliding back and forth with split-second precision. Then, with pressure on the gauge, you give



BOILER BUILDING KIT includes brazed, pretested barrel, stack, vaporizing alcohol burner, water gauge, safety valve, throttle and steam line, sheet-iron casing, asbestos lining and cast-iron end plates. Assembly is easy as all holes are predrilled and bosses are already tapped for all the boiler fittings.



BARREL SLIPS into cast end plates. Jacket with lining is placed between them and the assembly clamped with long tie bolts and nuts. Under view shows superheater tube (in center) and two water tubes. Tapped pads for fittings are already brazed to barrel. Boiler can make more steam than engine can use.

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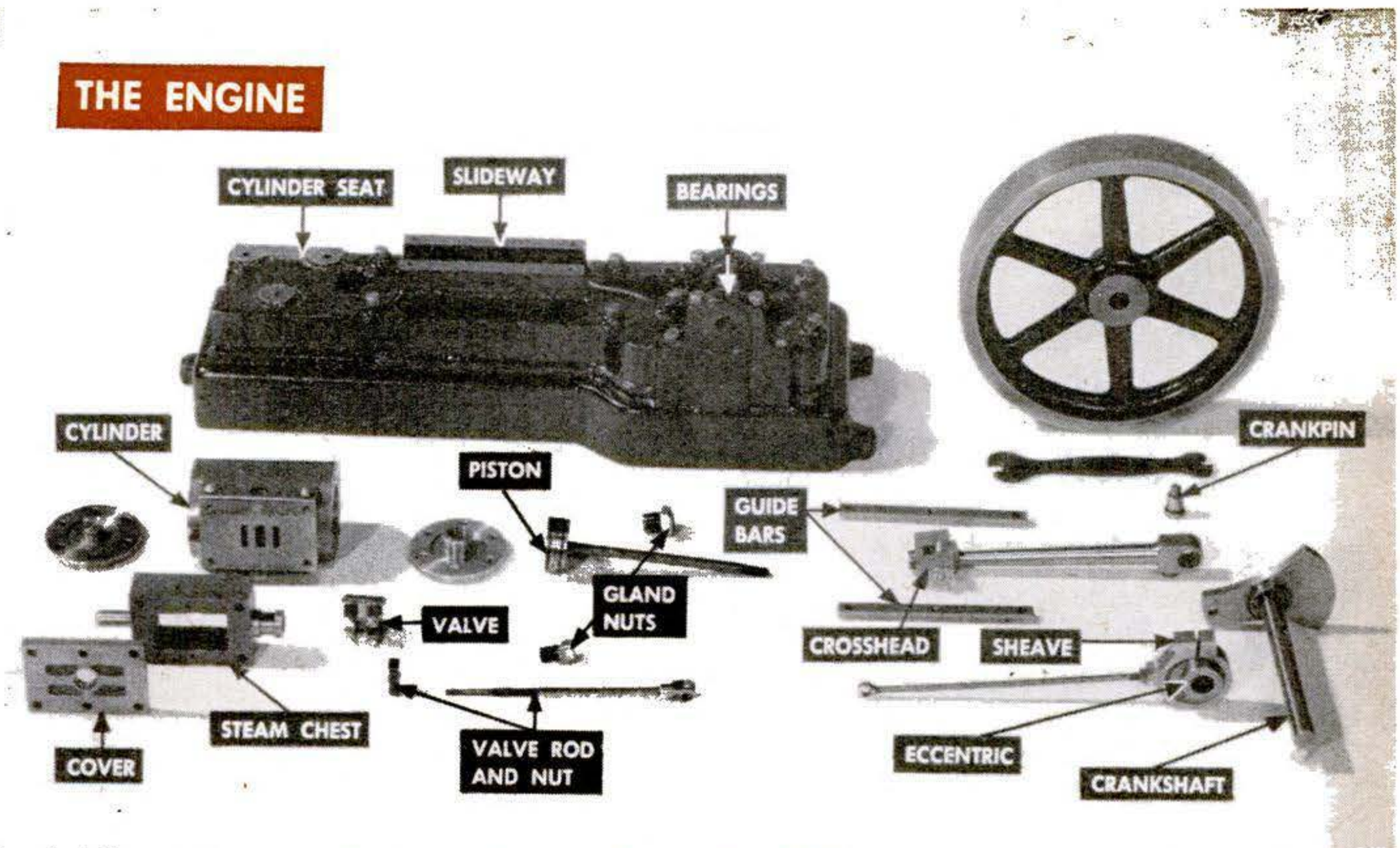
THE ENGINE



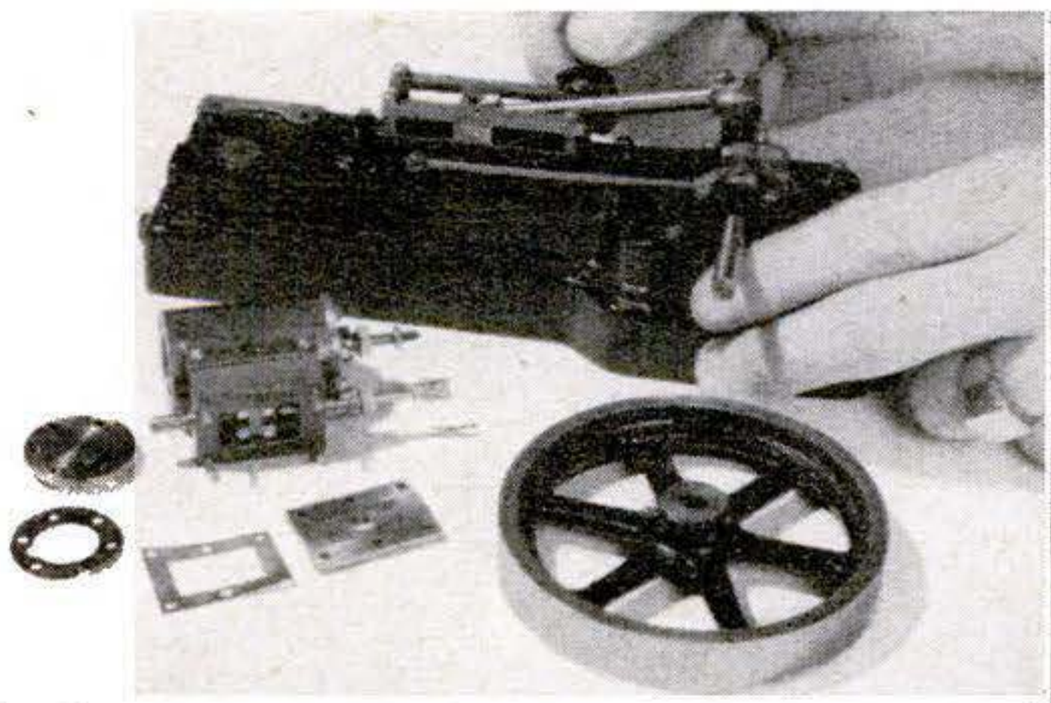
ENGINE KIT includes all parts shown, plus gaskets, hex-head bolts, nuts and setscrews. No drilling, tapping or turning is required. A beginner can assemble engine in two hours.

the valve a half turn and the flywheel instantly becomes a blurred disk, the crosshead a streak of golden light, the rod a silvery vee.

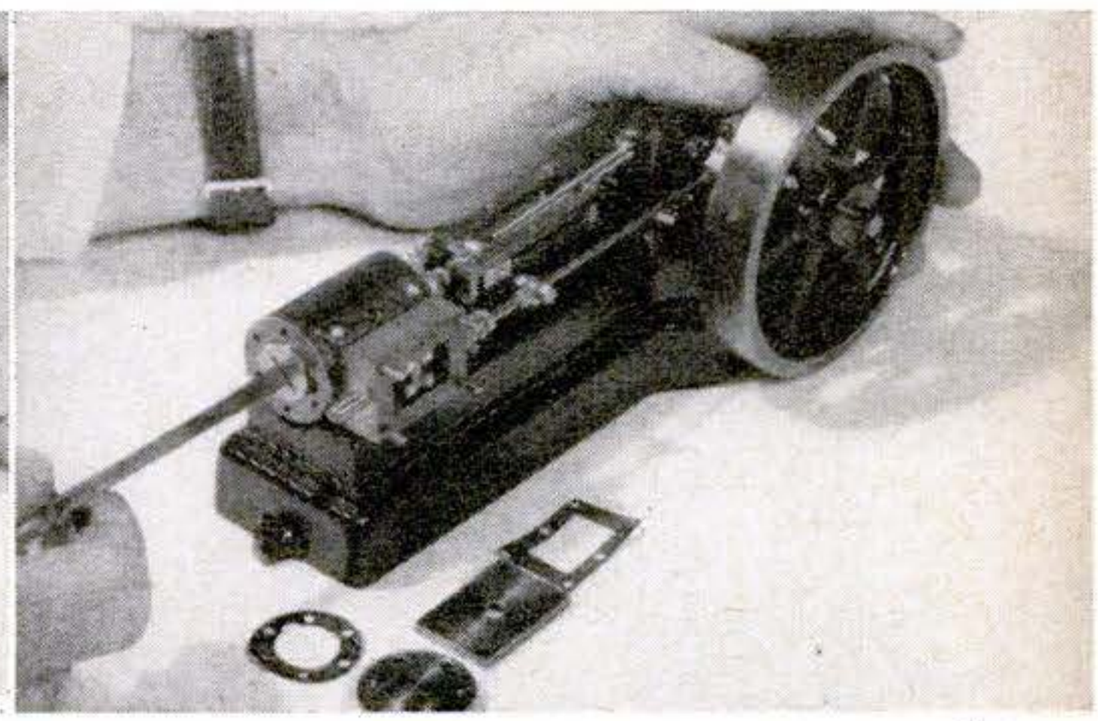
What you've built is a realistic model of the mill engines that powered factories at the turn of the century. With moderate boiler pressure—30 to 60 lb.—it has plenty of power to run small working models, a miniature generator, hoist or other light machinery. If fitted with a lubricator and feed pump, the little engine can be run as long as you please.

Made by Stuart Turner, Ltd., of England, the kit can be bought in this country for about $15, postage extra.* A pretimed crankshaft insures correct valve setting even if the builder knows nothing about steam engines.

The boiler, available as a separate kit, has a finished, pretested barrel with brazed ends, water and superheater tubes. The safety valve is set for a safe pressure. Also made by Stuart Turner, Ltd., the kit sells for about $17 plus postage. Pressure gauge and feed pump are optional extras. END



SHEAVE IS FITTED to eccentric, and with this between bearings, shaft is slipped in and eccentric setscrew tightened into predrilled hole, which sets valve timing. Crosshead is retained on slideway by guide bars mounted with spacers and bolts as shown. Steam chest with valve in is slipped onto cylinder studs.



SCREWDRIVER IS USED to turn piston rod into crosshead until, at top dead center, the piston is flush with steam recess. Rear cover is bolted on and valve positioned by screwing rod in or out of valve nut so that ports are uncovered equally at ends of eccentric stroke. Adding steam-chest cover finishes engine.

Can be purchased from Floyd McGuckin, 314 N. Monroe St., Ridgewood, N. J.

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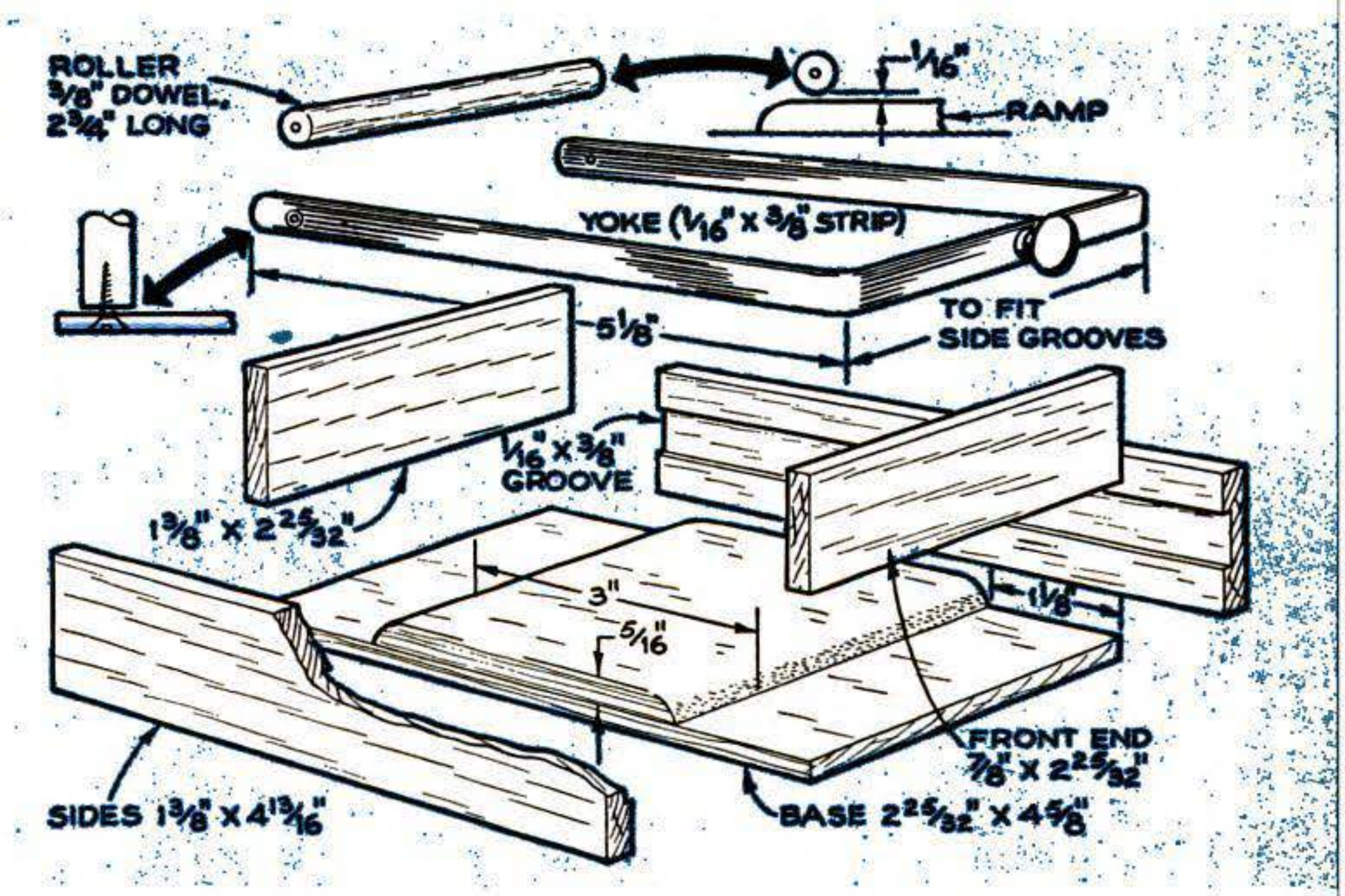
WITH THIS BOX YOU CAN

Roll 'em, Store 'em, Smoke'em

It's ornamental as well as useful, and any home craftsman can build it quickly.

ASSEMBLY LINE production is easy with this homemade cigarette roller. It turns out smokes as fast as you can load it. You can experiment with different tobacco blends and even insert filters if you like. Plastic cigarette box rests on top of the machine when it's not in use.



YOU don't have to ride the range to find advantages in rolling your own cigarettes, nor develop a trick thumb to do it. In an evening you can make a rolling machine attractive enough to keep on the living-room table. In another evening you can build a plastic cigarette box to go on top of it, making the gadget still easier to look at and forestalling your wife's impulse to stuff the whole works into a kitchen drawer. The outfit will turn out a big handful of tight, well-packed cigarettes from each 15-cent package of tobacco. Papers are 30 for a penny.

The rolling machine. Build a wooden box around a bottom 1/32" wider than the length of standard cigarette paper. Both sides of the box must have a shallow groove inside for the sliding yoke. Find the yoke material first (1/16"-by-3/8" metal strip is fine) and cut the grooves to suit it, either with knife and chisel, or by a few passes over a circular saw.

Shape the wooden ramp with knife, rasp and sandpaper. Then assemble the box, except for the front end, with glue and brads. Bend the yoke to slide inside the grooves. Countersink a hole in each end for a tiny flathead wood screw. Cut the roller from 3/8" dowel, centering 1/16" screw holes in each end, and mount the roller to rotate freely. Slide the yoke in, and glue in the front box end.

Rubberized cloth is ideal for the apron, but any thin, close-woven cloth will do.

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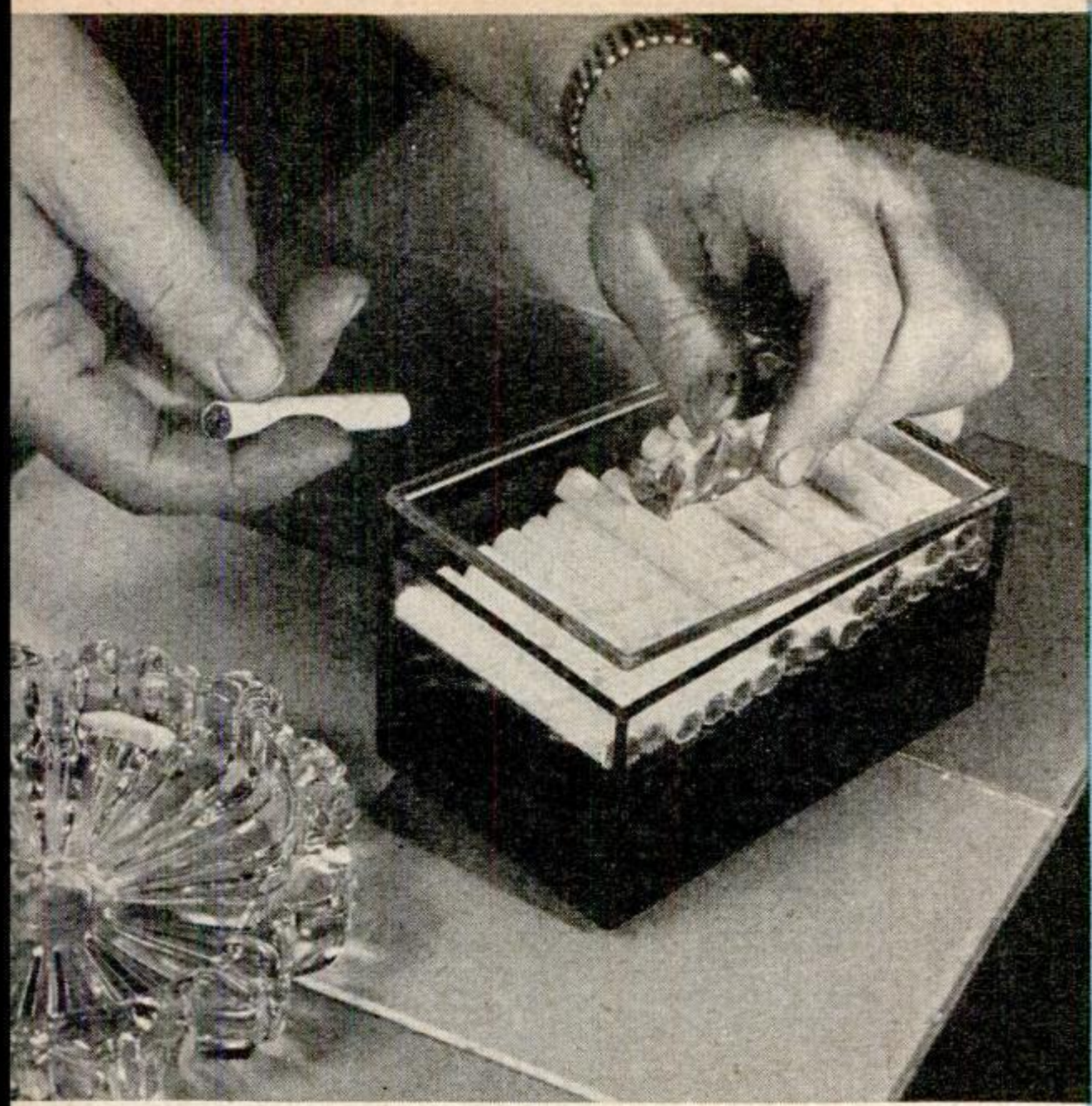
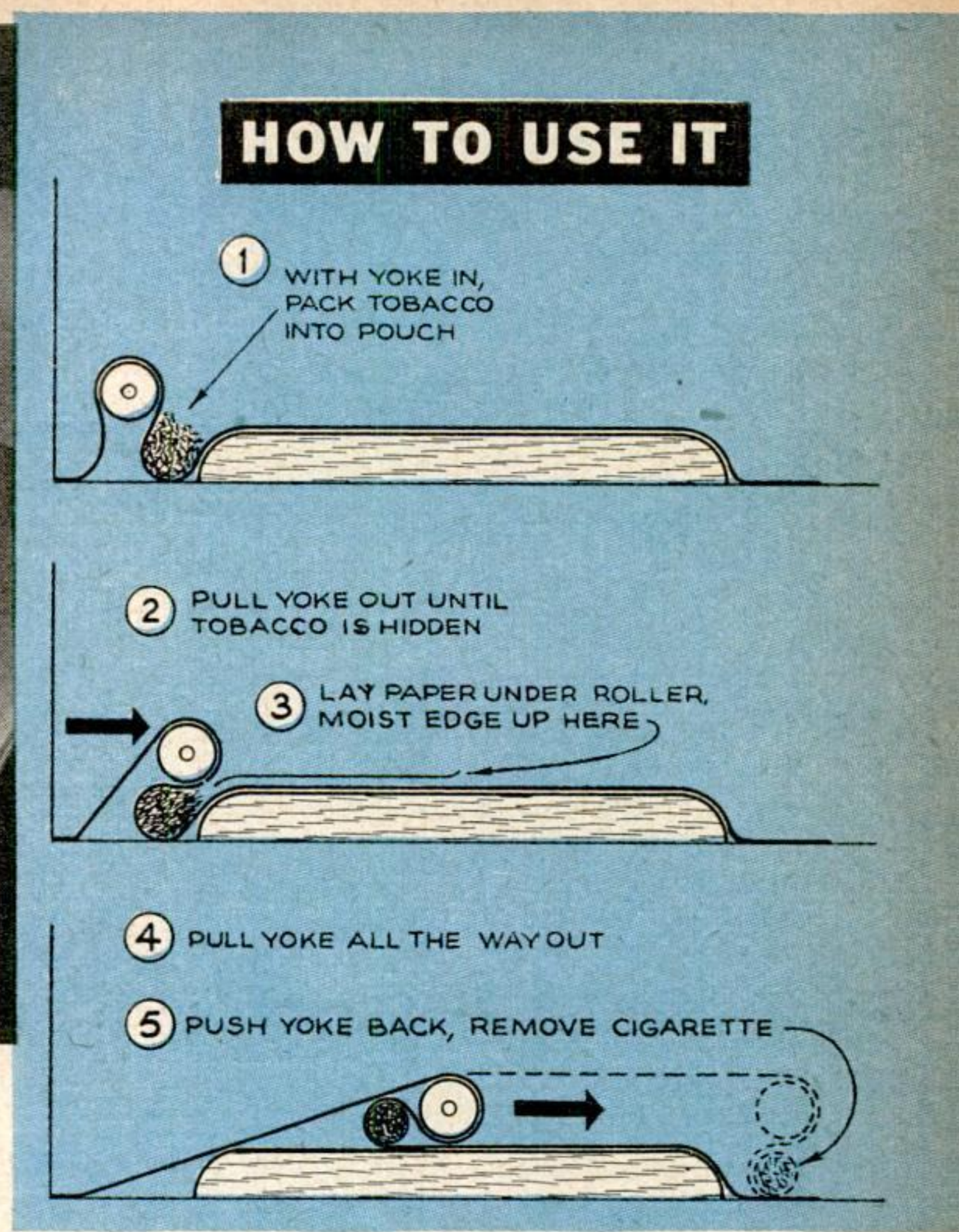
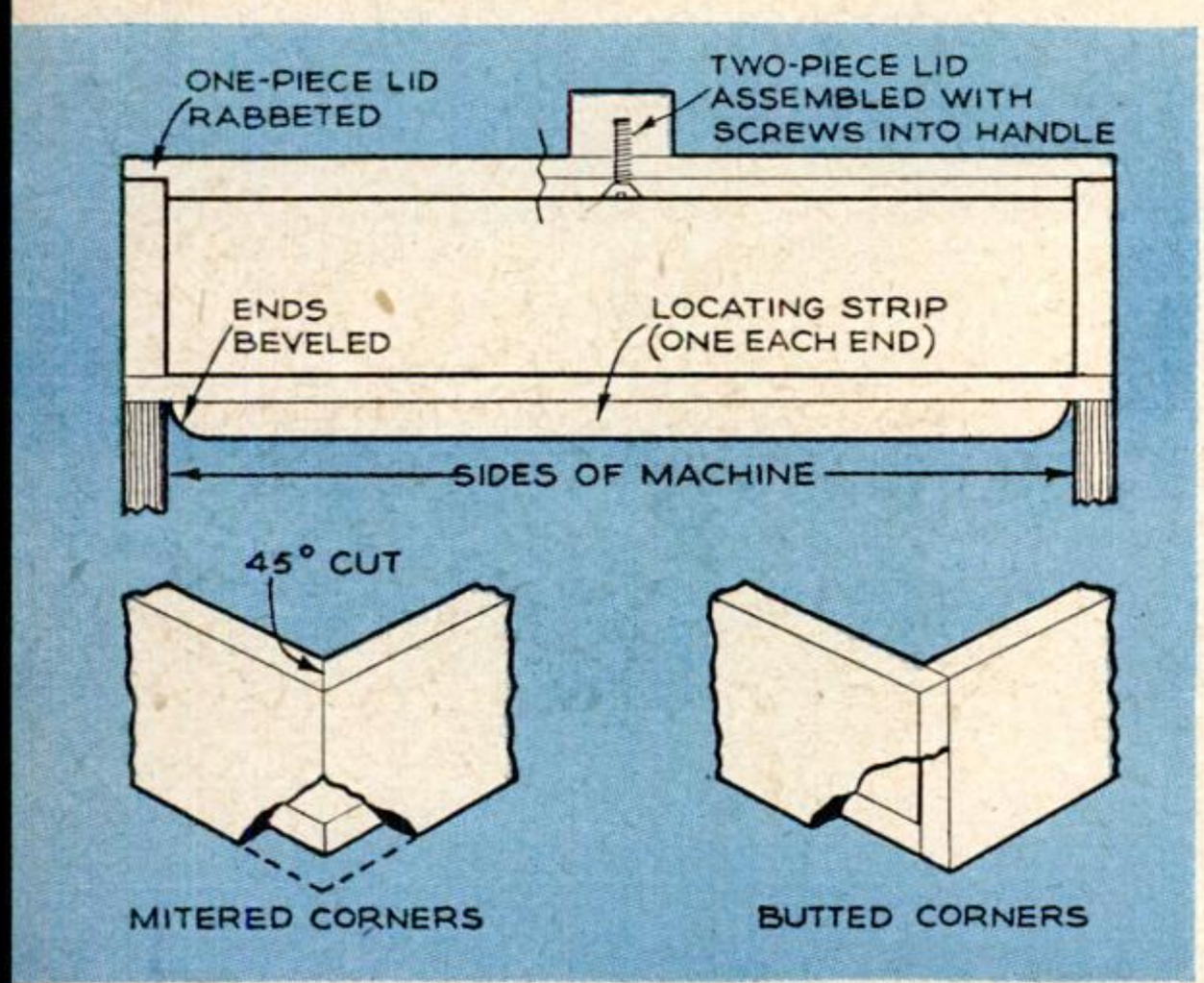
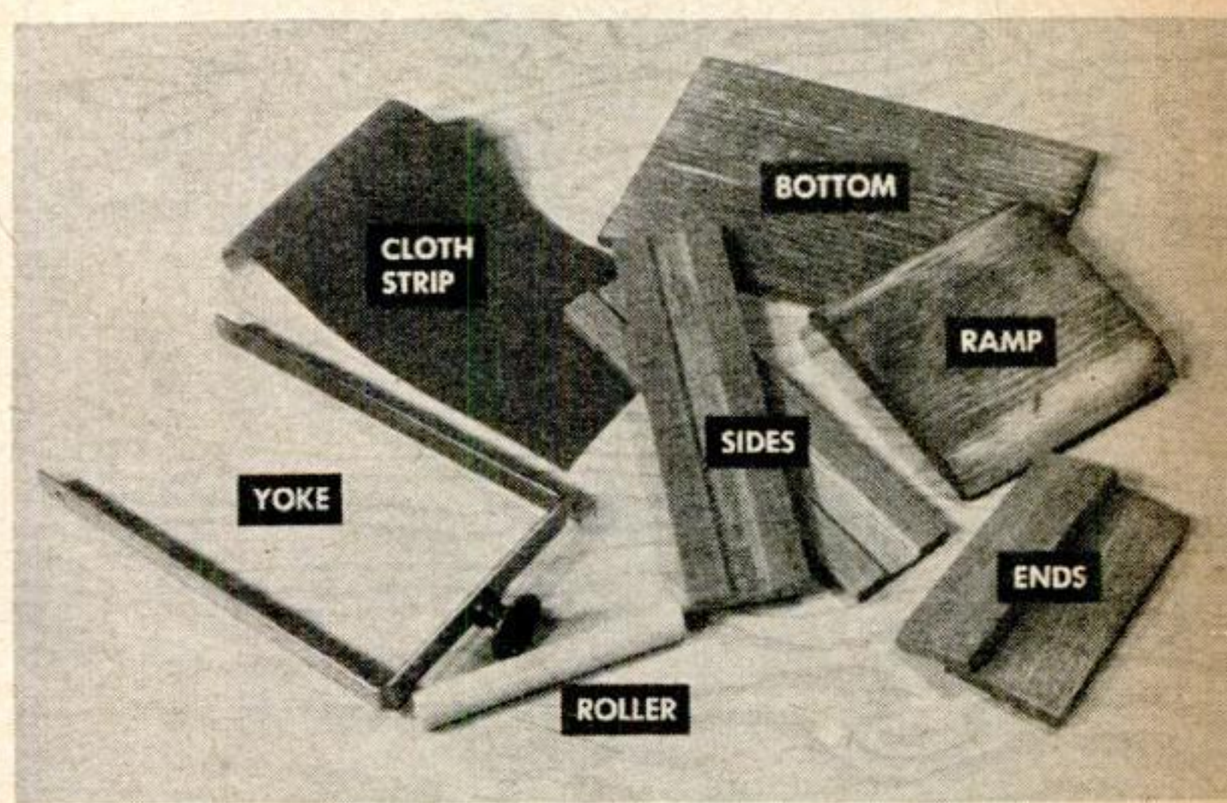


BOX LIFTS OFF when you want to take a supply of smokes to your desk or armchair. Two strips cemented under the bottom align it inside the edges of the rolling machine, and serve as feet when the box is used by itself.







CUT THE PARTS from wood 3/16″ or ¼″ thick. Inside dimensions are important as width must fit standard cigarette paper. Bottom comes flush with ends of sides, but fits between them. Rear end overlaps bottom.

Glue down the back end, tack the front end down, and try rolling a cigarette. Too long a strip will roll them loose. When you get the kind of cigarette you like, mark the length of the strip and cement the front end.

The plastic box. Cut a bottom of ⅛″ sheet plastic ¼″ smaller each way than the outside dimensions of the machine. Cement 15/16″-high sides and ends of the same material around the bottom, using butt or miter joints made with the appropriate cement.

Cut the lid to outer box dimensions from 3/16″ or ¼″ material. Rabbet all four edges to fit inside, and cement on a bit of rod or a knob as a handle. You can make the lid of ⅛″ sheet by cutting one piece to outside and one to inside box dimensions, fastening them together with the screws that hold on the handle. Buff all exposed edges for a sparkling finish. END

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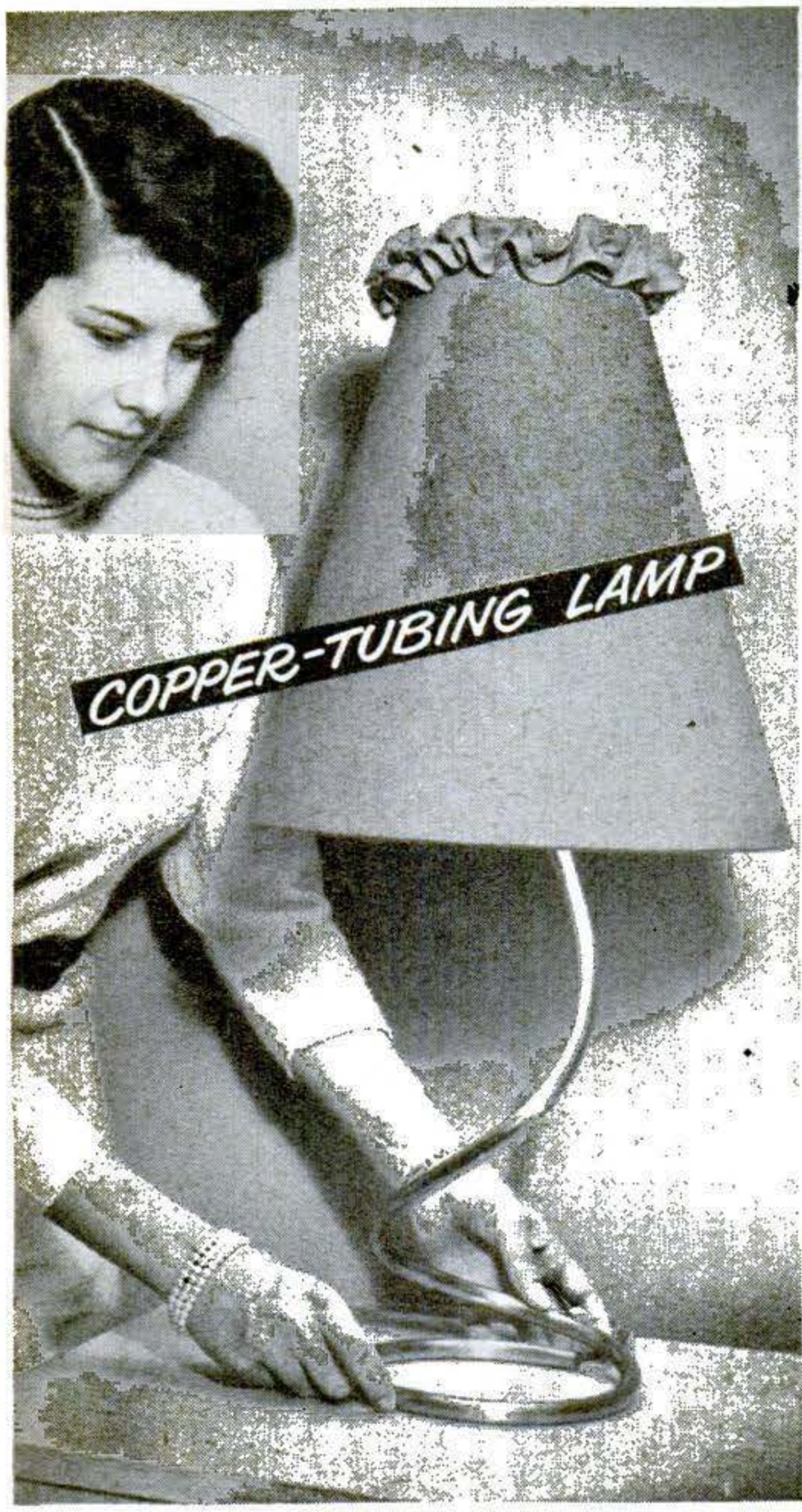
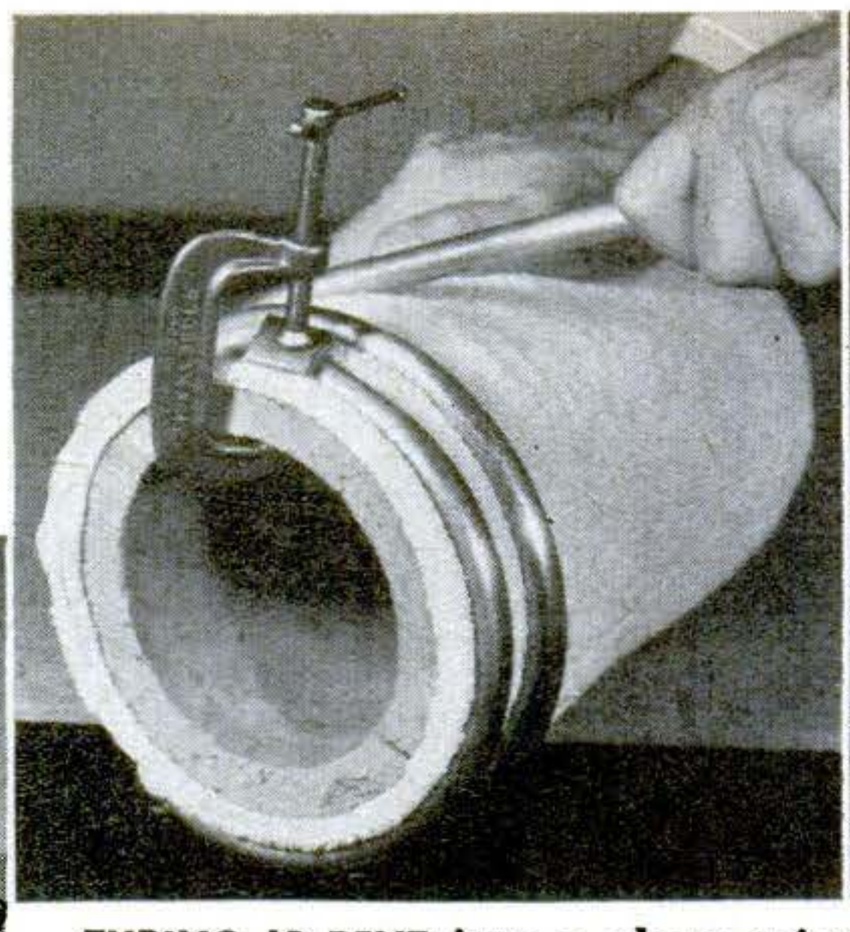
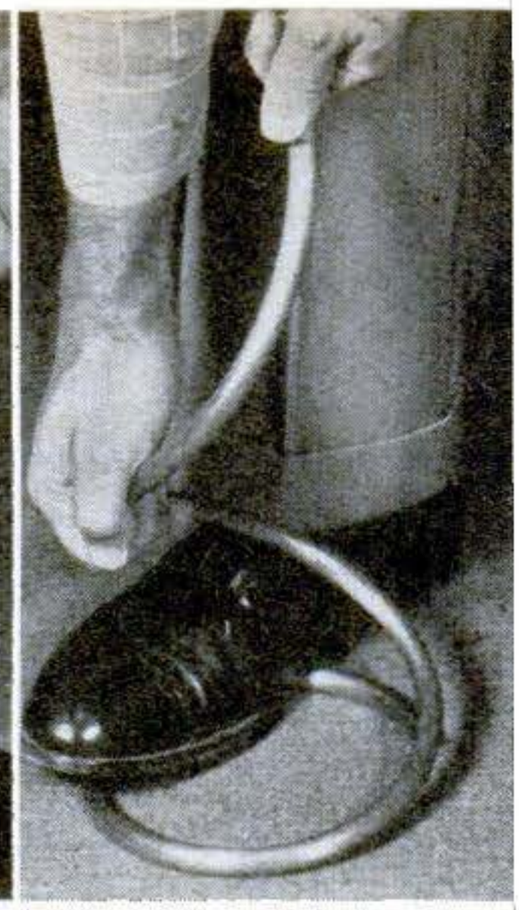
One Evening Shop Projects







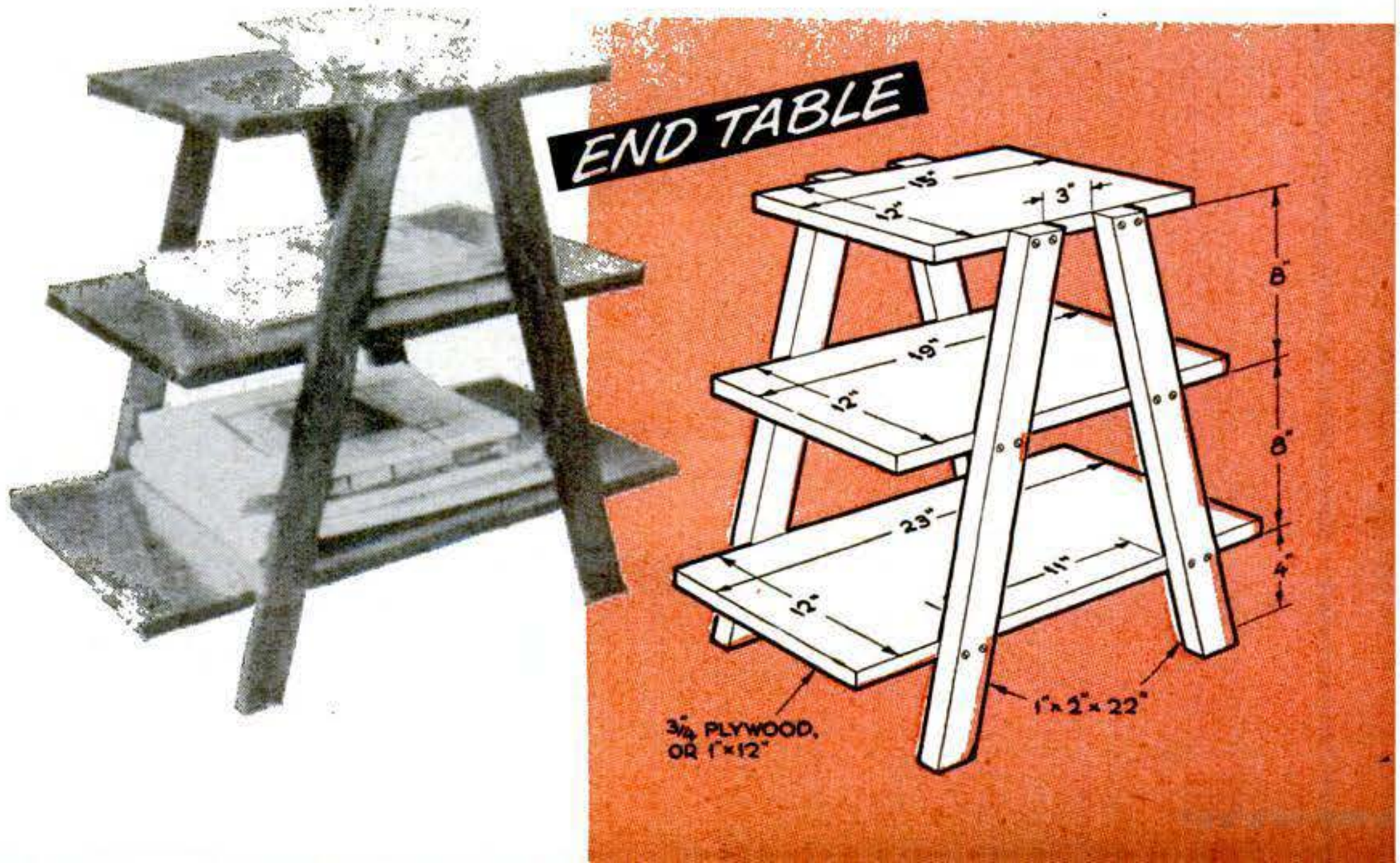
TUBING IS BENT into a close spiral by clamping it on a jig of iron or tile pipe with an outer diameter of about 6″ (left above). Towel or piece of cardboard should be wrapped around jig to prevent scratches. Then spring tubing up by hand, spiraling it inward into desired shape. Keep tubing filled with sand until all bending is finished.

If you scrounge some ordinary copper tubing, you can make a very handsome modern lamp for no more than the cost of the electrical parts and shade. The tubing is surprisingly easy to bend, and it won't kink if you keep it filled with fine sand, stoppering the ends tightly with whittled plugs.

The socket and shade harp are connected to the tubing base with a ½″ piece of the standard ⅛″ threaded pipe sold for lamp making. This is a bit smaller than the inside diameter of the tubing, so the inner surface of the top of the tubing is built up with a thin layer of rosin-core solder. The pipe will cut its own threads into the solder to make a sturdy joint.

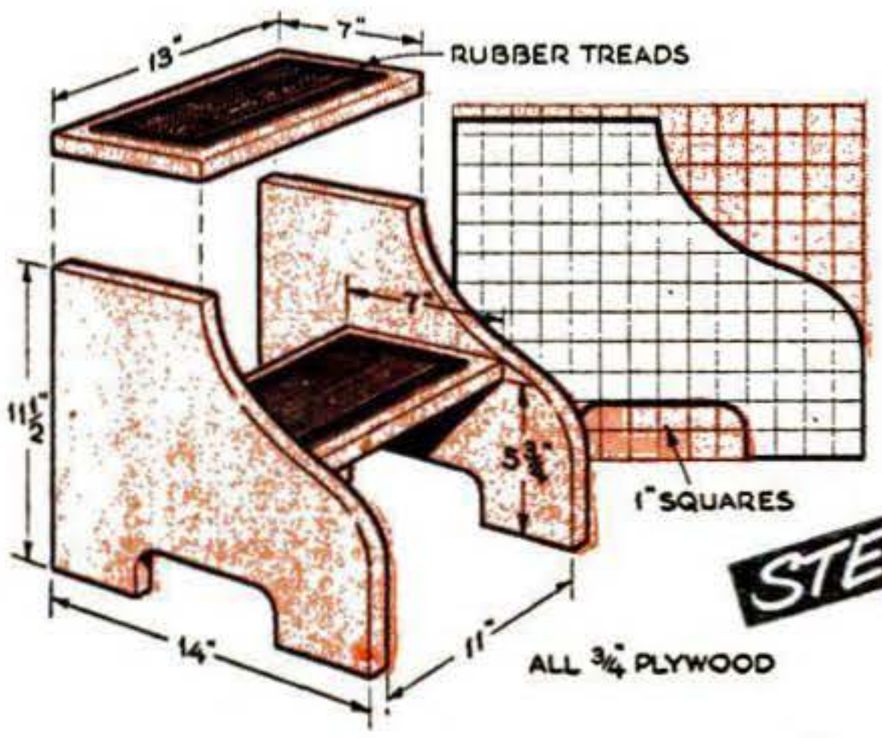
For a bright finish, polish the copper tubing with 3/0 steel wool and then coat it with metal brushing lacquer.—*Milt Grassell, Corvallis, Ore.*

Three rectangles of ¾″ plywood and a few feet of one-by-two make a simple end table that will keep magazines handy to your easy chair. The legs are fastened to each shelf with countersunk 1½″ screws, and the holes concealed with composition wood filler.—*Gerald M. Gardner, Albuquerque, N. M.*

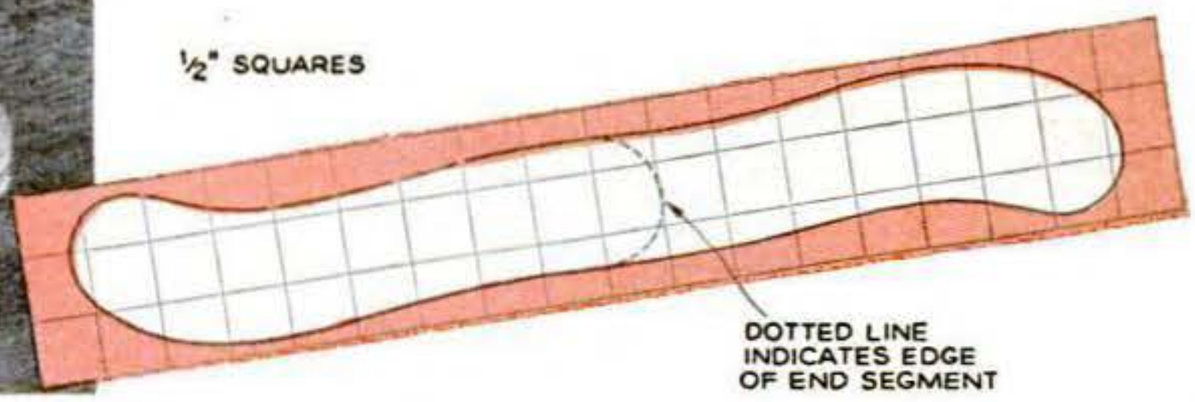


Junior can go get his own drink of water if he has a step stool. Even with hand tools it is a quick job and requires only a little ¾″ plywood.

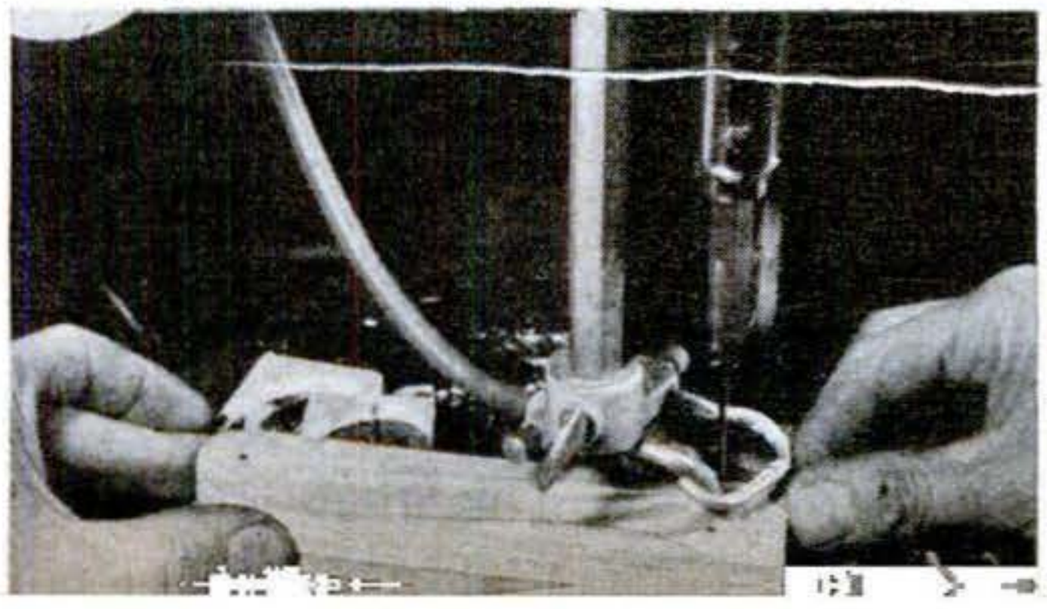
The inside step is assembled first, using countersunk eightpenny finishing nails or 1¾″ screws through the sidepieces. The top step overhangs about ¼″ at each end. The rubber treads, precut ½″ smaller than the steps, are laid into the wet enamel while the stool is being finished. Four brads hold the treads until the paint dries.—*Victor H. Lamoy, Upper Jay, N.Y.*



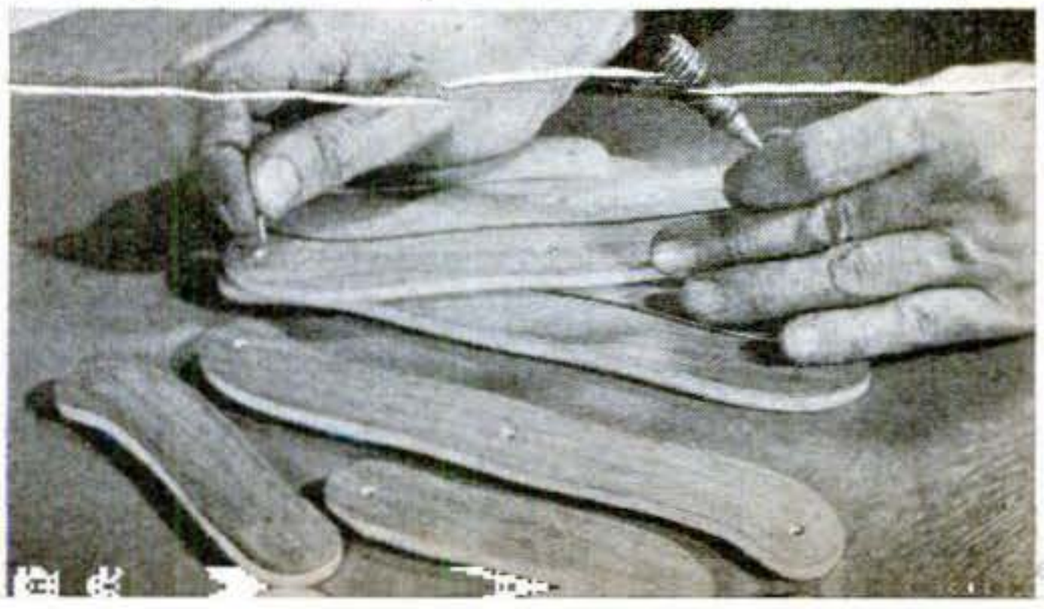
Old-fashioned lazy tongs find a modern use in an adjustable hot plate—you can stretch it out to hold a big meat platter or squeeze it up for a small teapot. This one was simply made of ¼″-plywood segments screwed together. For attractive grain like the birch shown here, a good heat-resistant finish is several coats of boiled linseed oil, each coat allowed to dry a day or more.—*Walter E. Burton, Akron, Ohio.*



STACKS OF PLYWOOD are held by nails through pivot points for jigsawing several segments. Trivet has 1″-by-7″ segments, can expand from 5½″-by-8″ to 7″-by-18″.



BORE AND COUNTERSINK holes for ⅜″ No. 2 flathead screws in top segment layer only. Assemble center segments first and punch through holes to spot screws in bottom layer.



Homemade Tester Spots

An ohmmeter costs little time or money to build and tells you quickly why the toaster stays cold or the car horn is silent.

By W. S. Kals

SERVICEMEN quickly find what's wrong with a balky iron or toaster by systematically checking for shorts or the high resistance that means a broken connection. You can borrow their technique—without laying out $10 or more for professional instruments. A tester adequate for home use requires a milliammeter—cheap and widely available in surplus and radio-parts stores—a variable resistance or old radio potentiometer, and a glow lamp.

The milliammeter is used as an ohmmeter to measure low to moderate resistances. It is adjusted with the potentiometer, which must be able to provide full-scale deflection of the meter needle when the test probes are touched together (resistance being measured is zero). If the pot resistance isn't high enough to do this, add small fixed resistors in series until it will. If the pot resistance is too high, add more batteries (in series).

The glow lamp indicates high resistances—leaks. It shares one of the ohmmeter leads, but is not battery-powered and must be connected to the regular house electrical line.

Calibration. Since the ohmmeter actually measures resistance (unlike the glow lamp), its milliampere markings must be converted to ohms. If you want to avoid calculations, just use ordinary light bulbs or radio resistors to set several calibration points. A chart at the end of this article gives approximate cold resistances for electric-

for electric shocks. One woman was killed when she inserted the frayed cord of her vacuum cleaner into a floor lamp. Her hand, damp with perspiration, was on a radiator. This completed an electrical circuit.

FRAYED cords and insulation should always be replaced. No appliance should be run by obtaining current through another. Wetness of the skin reduces the body's resistance. More tips: Never turn on two lamps at the same instant. Never touch an electrical device or switch while holding a metal doorknob, or when standing in a wet place, or in a bathtub. Never touch any electrical appliance with wet hands. Turn off equipment after use. **Do not touch a person who has been shocked while he still touches the circuit. Push him off with a long board.**

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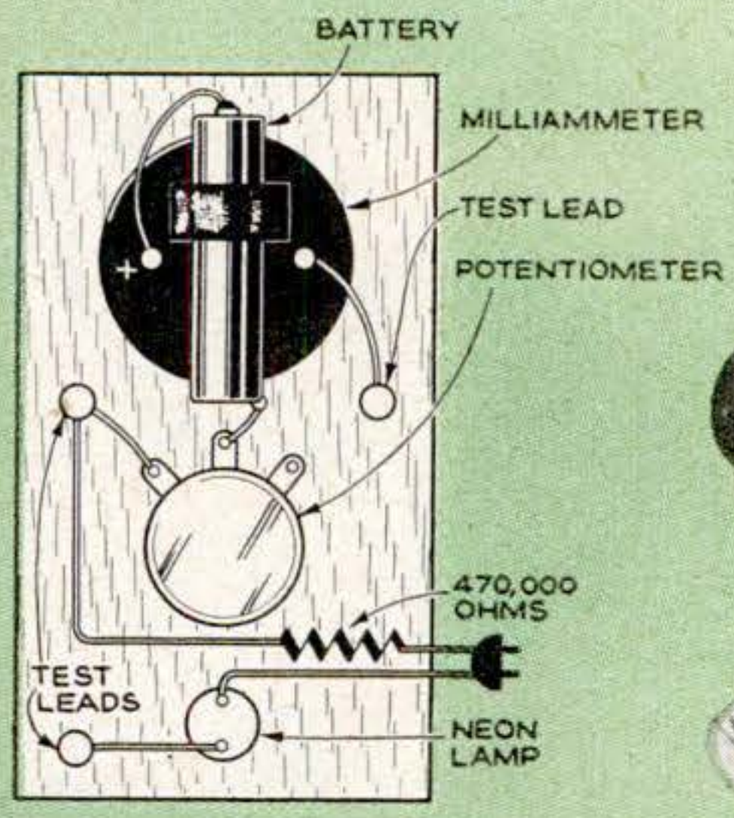
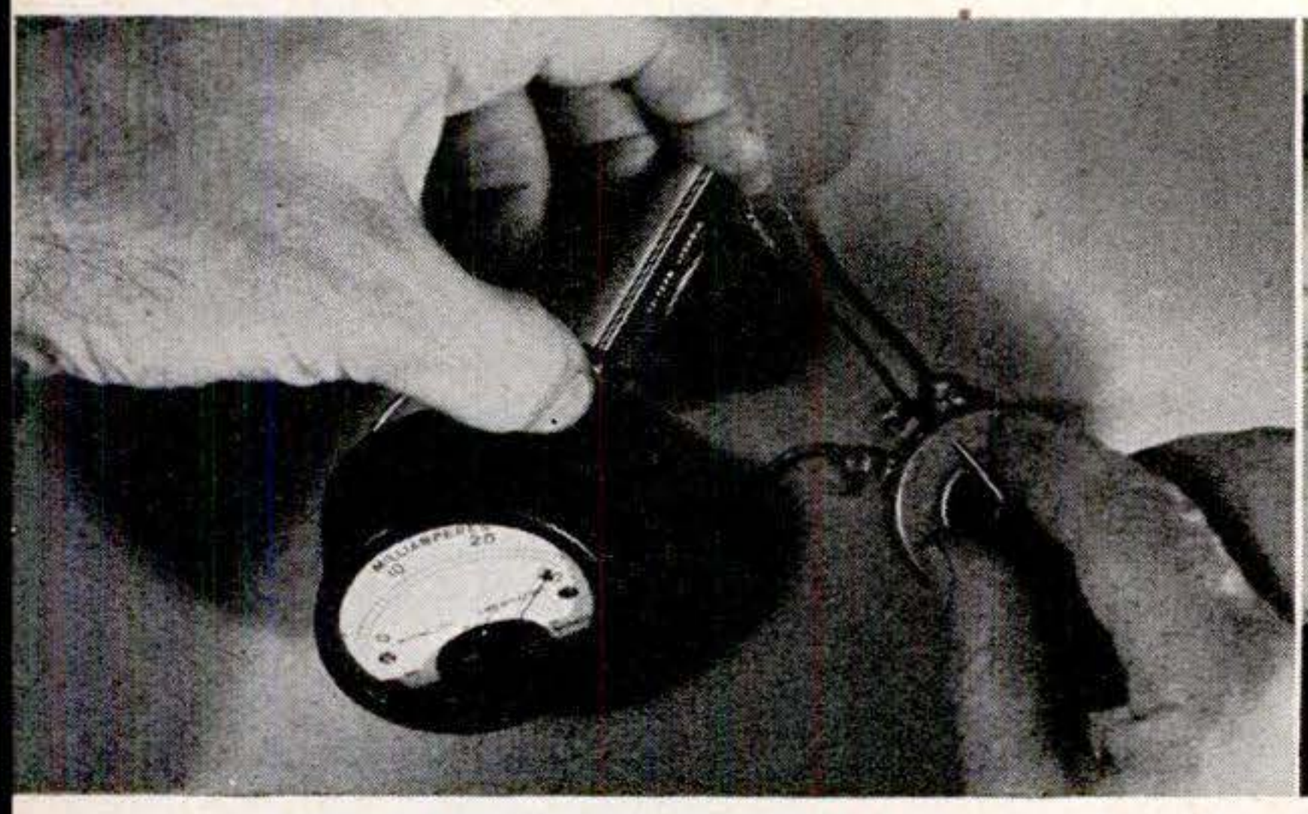
Appliance Troubles



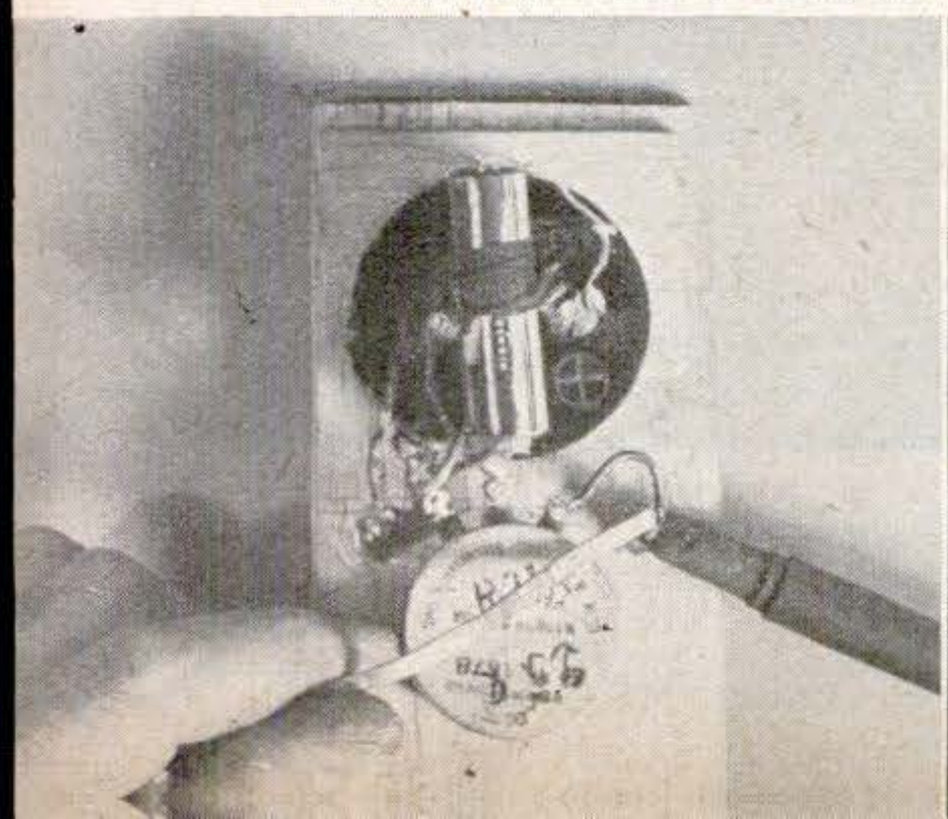


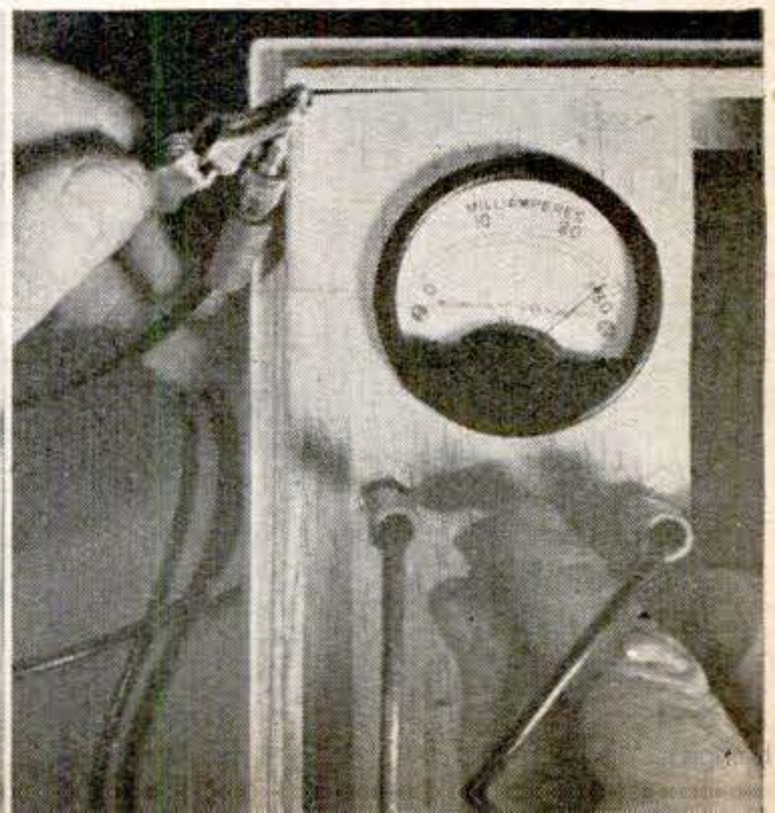
CHECK THE POTENTIOMETER before assembling the tester. Connected directly to battery and meter, it should adjust to give full reading.

KNOWN RESISTANCES, such as radio resistor or light bulb, permit quick test of meter range, and provide an easy way to calibrate it.

ALL CONNECTIONS ARE SOLDERED—even those to the battery (it should last a year). Friction tape holds battery.

OHMMETER MAY NEED ADJUSTMENT at infrequent intervals as the battery weakens with use. Set needle to zero (left below) by turning the small screw, then connect test leads together and adjust potentiometer (right below) to give highest reading.





light bulbs. You may be able to mark calibrations on the meter scale. Otherwise make up a chart listing the ohm values for the various milliampere readings and keep it inside the case of your tester.

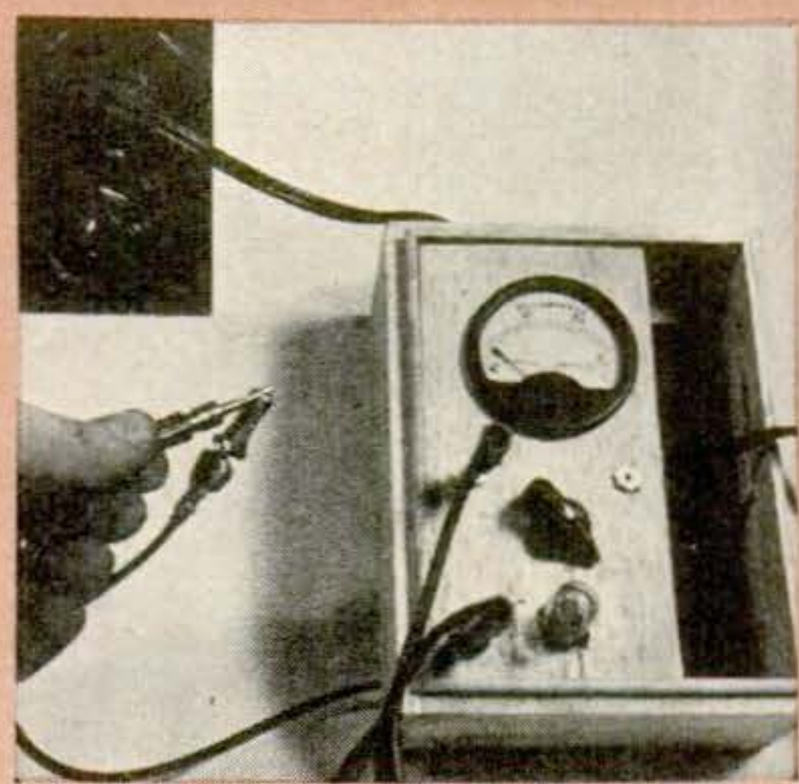
RESISTANCES OF COLD BULBS

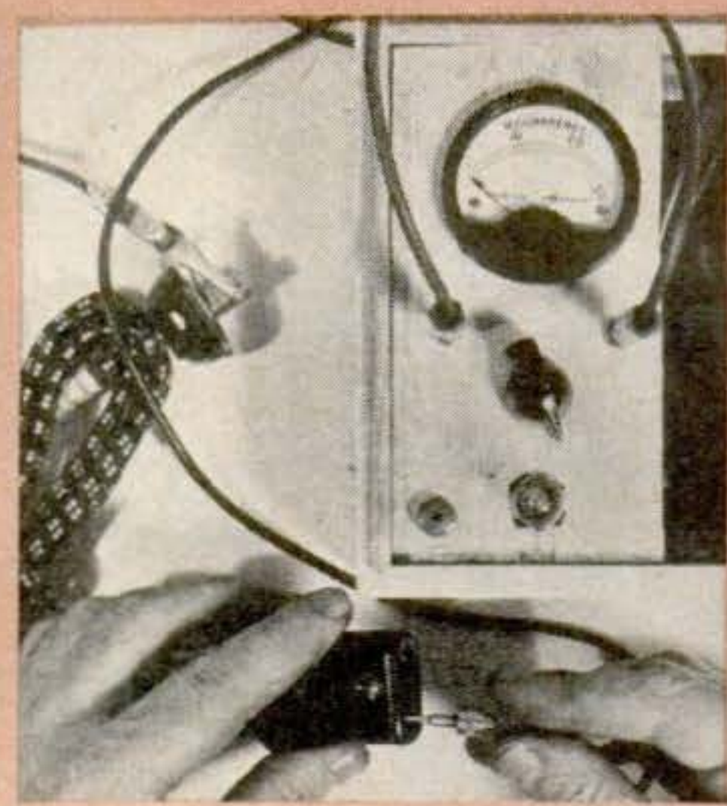
10 WATTS	180 OHMS
15 "	100 "
25 "	50 "
40 "	23 "
60 "	18 "
100 "	9 "
150 "	6 "
200 "	4 "
300 "	3 "

Trouble shooting will go faster if you follow a systematic step-by-step routine. It's a good idea to measure and note down resistances of your appliances while they are in working order; then you will have a reference point when repairs are necessary. Calculating resistances from wattage ratings is little help—that gives operating, hot resistance, which is far different from the resistance when the appliance is not working and cold.

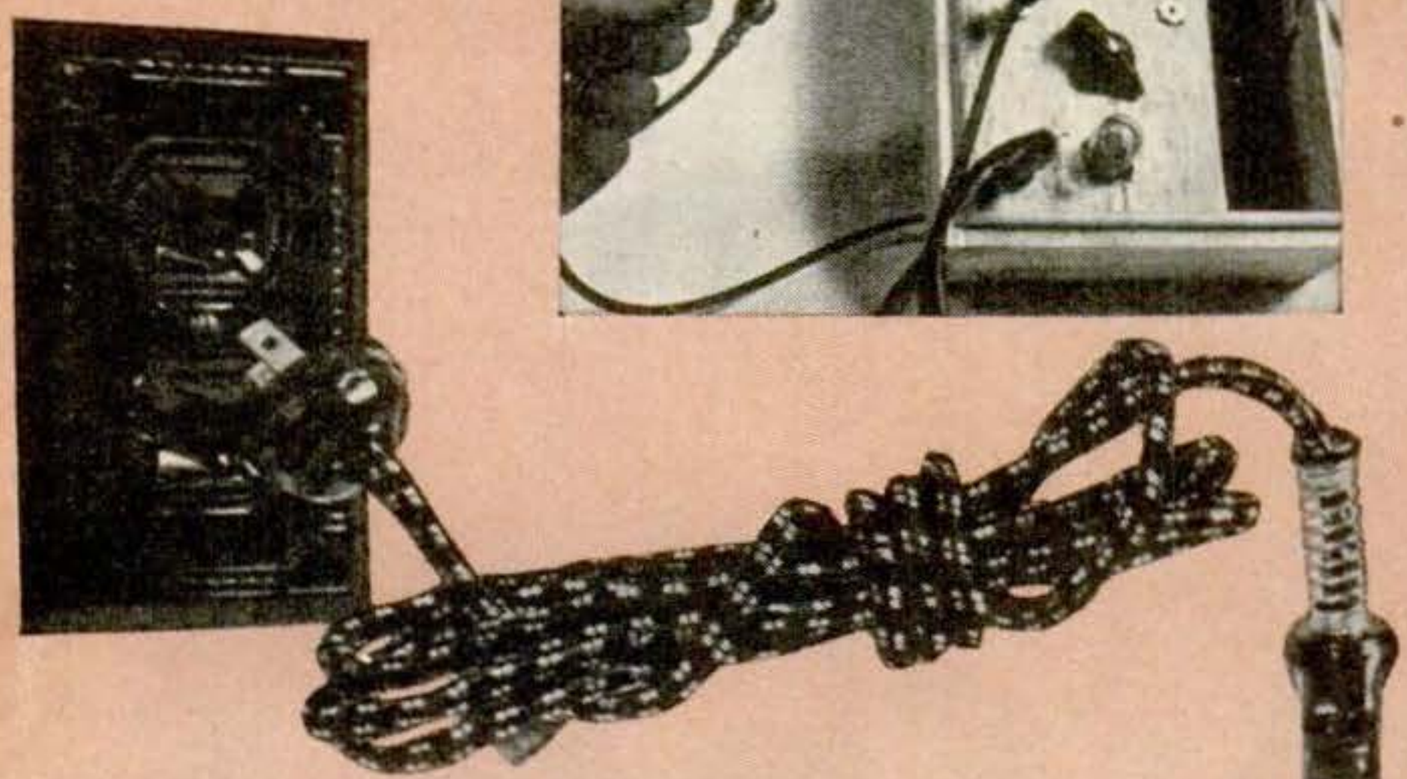
How to Diagnose a Sick Iron

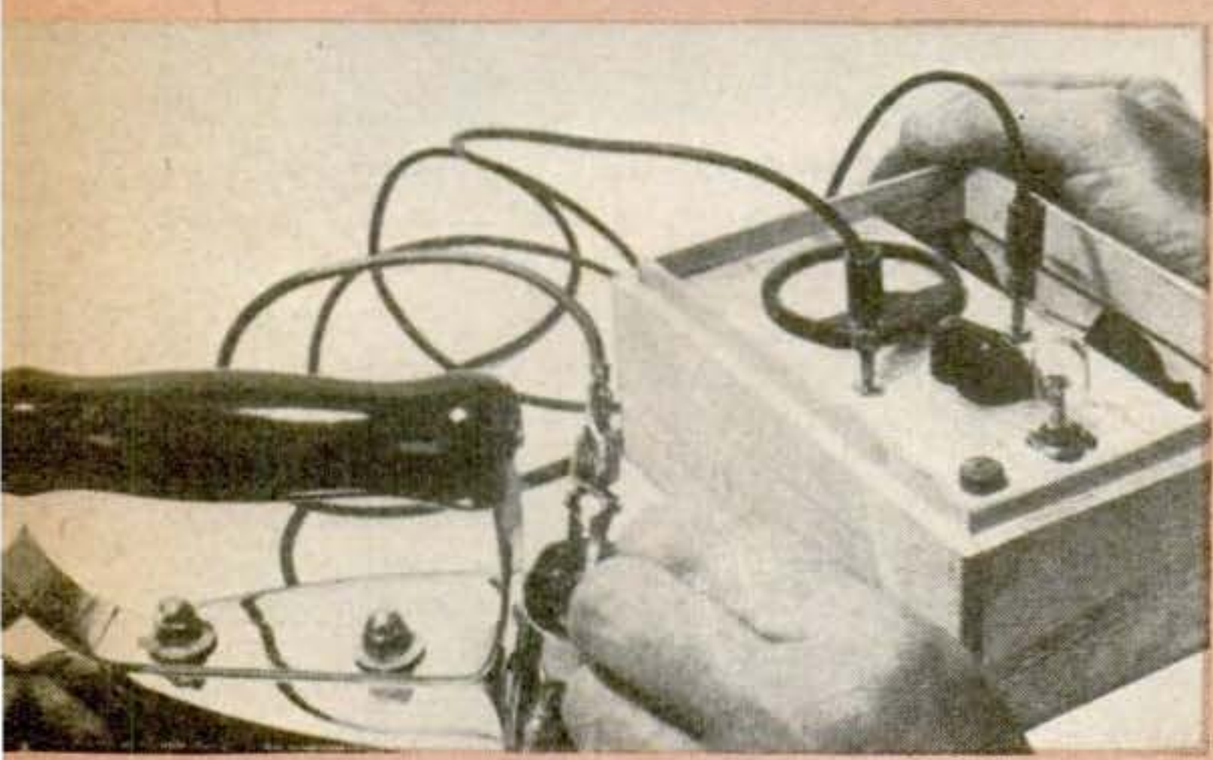
1 MAKE SURE IT'S THE IRON and not the outlet that is on the fritz. Plug in the glow lamp and touch its test leads together. If the lamp lights, you know that you have juice, anyway.

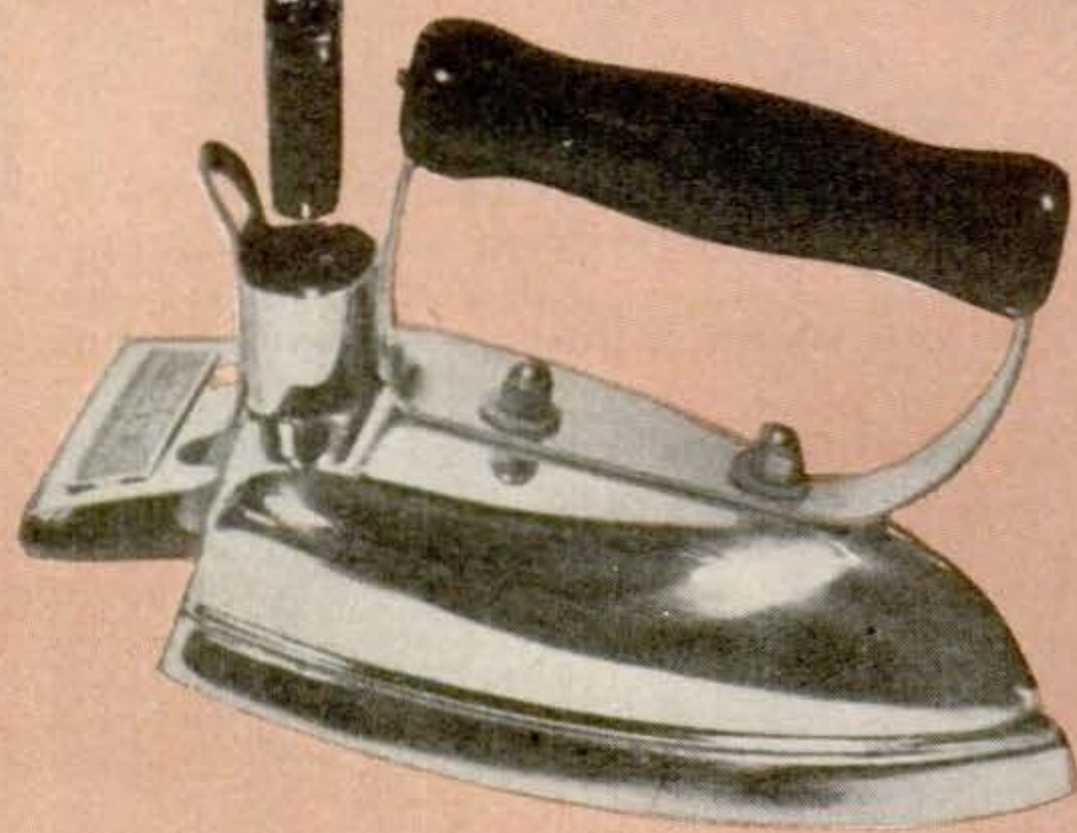




2 TEST THE CORD. With alligator clip on one prong of iron plug, try ohmmeter probe in each side of female plug while you twist cord. One side should give full-scale reading, other zero. If both give full reading, wires are touching (probably in plug). If neither gives full reading, wires are broken (probably in female plug). Repeat on other prong.







3 TEST THE IRON. Connect ohmmeter test probes to iron prongs with iron unplugged, cold, but switched on. No reading indicates broken inside connection, stuck thermostat or burned-out element. Reading higher than normal resistance of iron indicates poor inside connection. Full-scale reading indicates dead short inside iron (probably between prongs and heating element). After making repairs, always use glow lamp to check for leaks between prongs and iron body—appliance may work even with dangerous leak.

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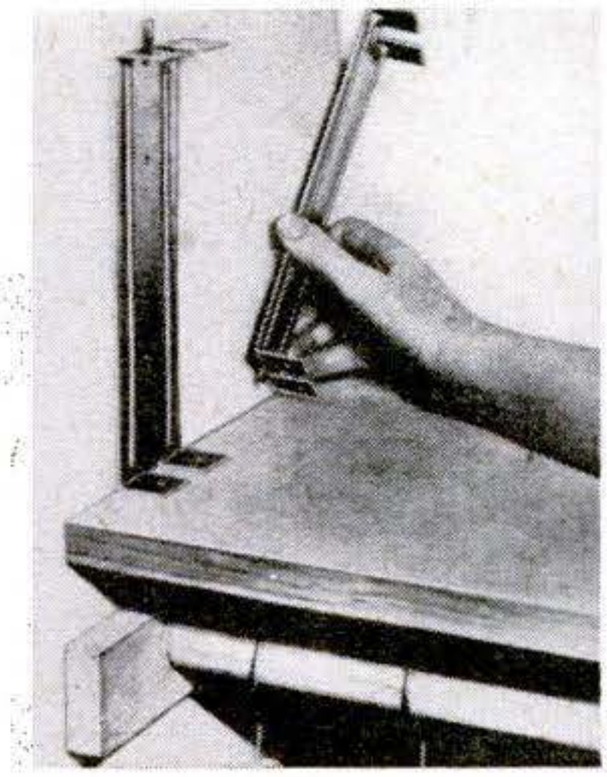
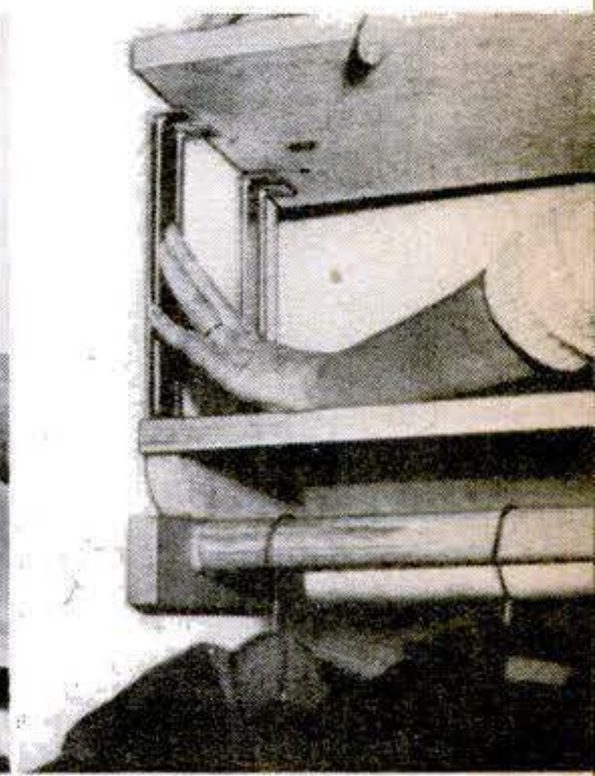
New for the Handy Man

1. Undercourse Built into Shingle Unit. A preassembled building unit saves 70 percent of the time usually needed to apply cedar shingles, claims the maker. Glumacs units—cedar shingles electronically glued to an 18″-by-46½″ insulating backer-board—are nailed over sheathing to provide both backer-board and exterior shingle of a double-coursed wall in one operation. The shingles come already stained.

2. Coating Toughens Work Gloves. Simply brushed on, this rubberlike coating gives ordinary work gloves a tough, flexible surface that protects against wear, water and oil. Its rough texture also provides a good grip on slippery materials. Glovex does not penetrate the canvas and is said not to affect inside softness of gloves.





3. Brackets Add Shelf. You don't even need a hammer to put an extra shelf in the clothes closet with these brackets. Tabs at the bottoms of the Jiffy Shelf Makers slip between the wall and the existing shelf. Similar tabs at the tops lock the new shelf in place. The brackets are 8″ high, cost about a dollar for a set of four.

Please turn the page for more new products.

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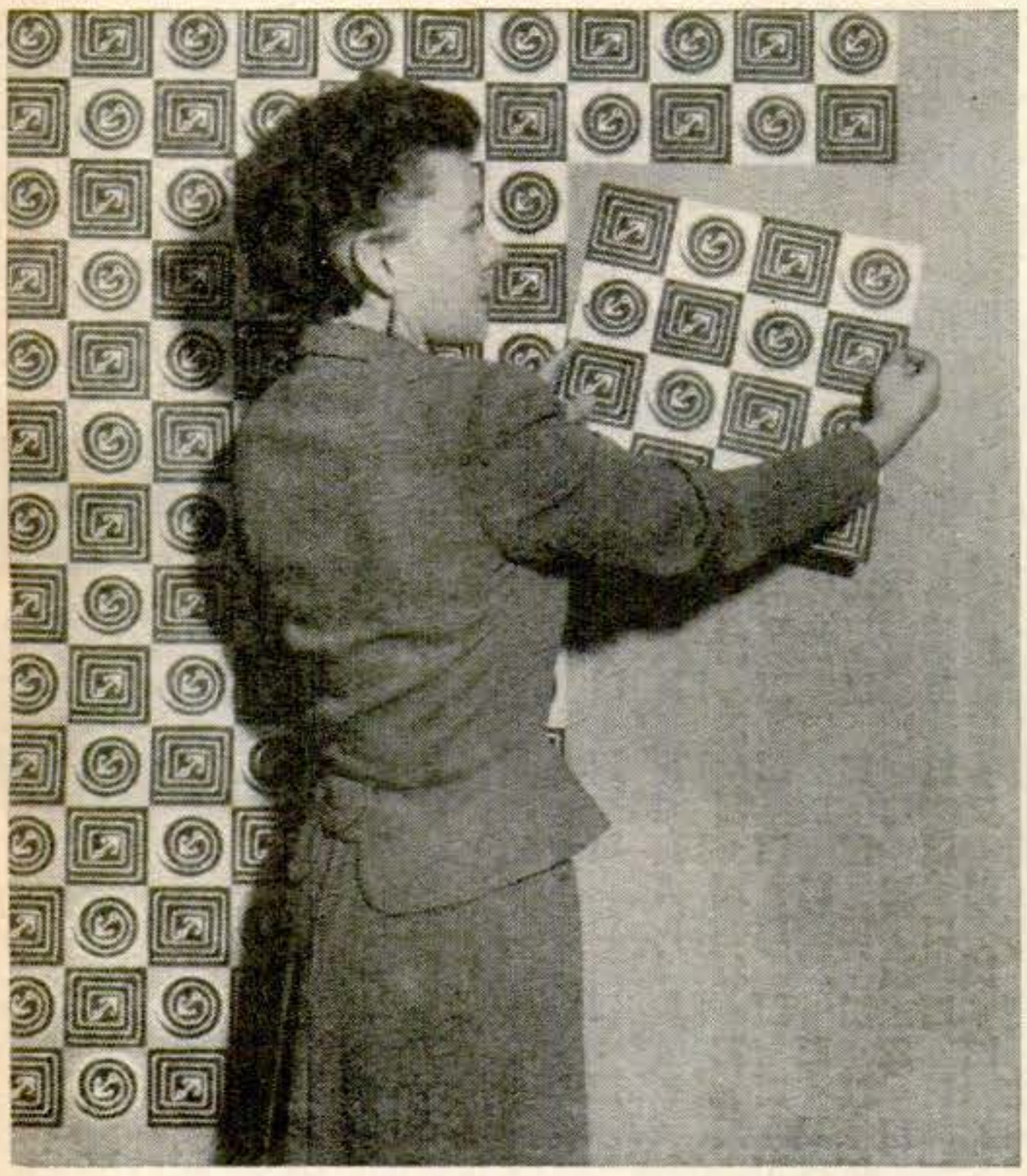
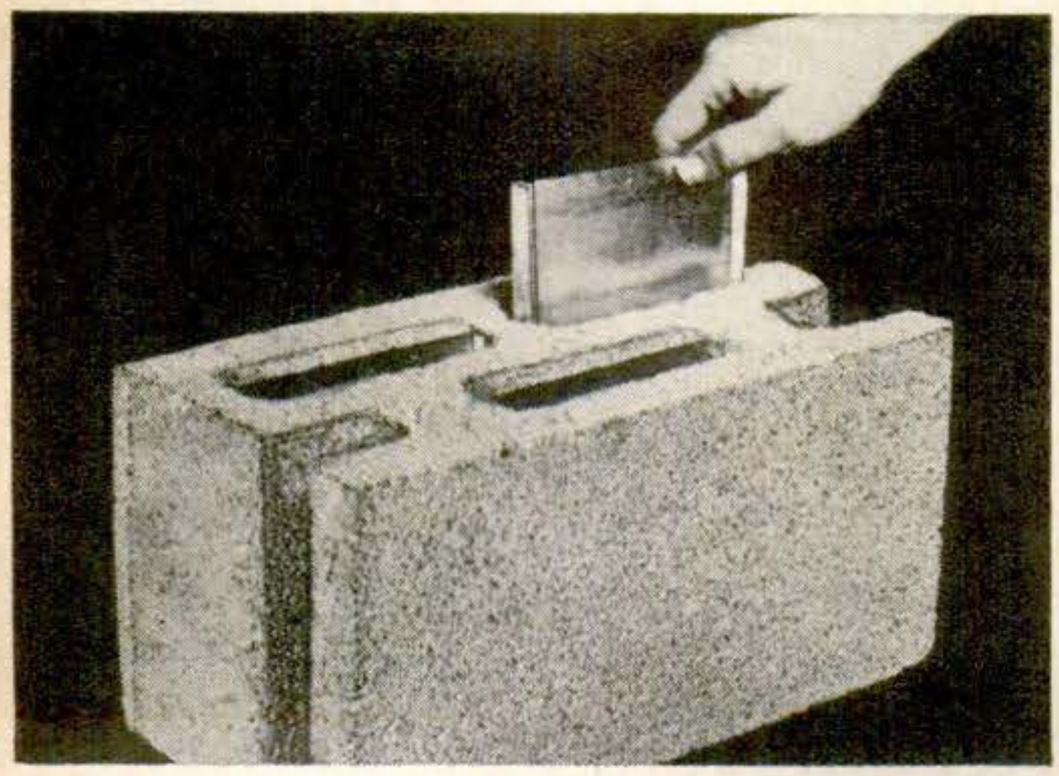
New for the Handy Man
(Continued)

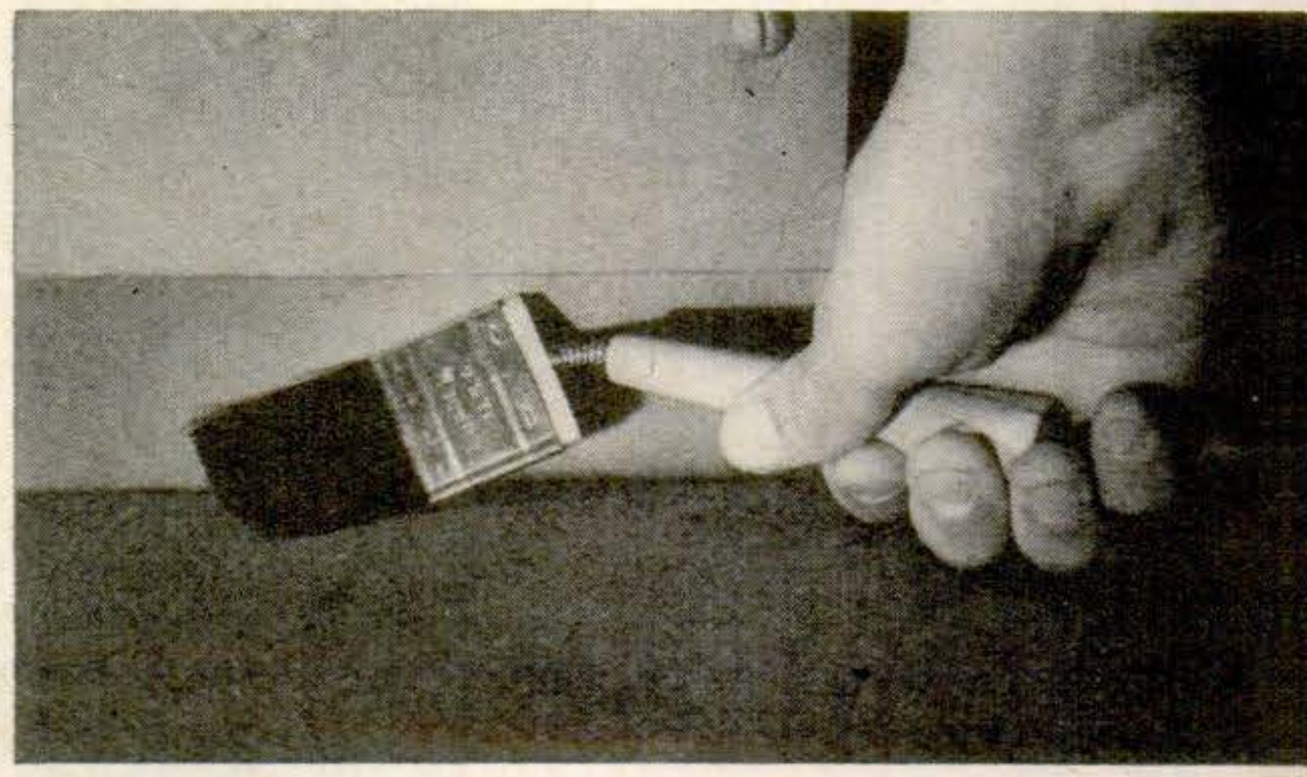


4. Wallpaper Squares Go Up Fast. One person can put up these small squares of wallpaper without the fuss of big sheets that are hard to handle and easily damaged. Each 14″ square is precut to join other squares without trimming or overlapping. The washable squares come in a number of patterns, are put on with ordinary paste. If a square becomes soiled, it can be replaced without repapering the whole wall.

5. Fabric Dyes Stain Furniture. You can use ordinary dime-store fabric dyes to finish unpainted furniture, reports one manufacturer. They're cheap and come in as many as 54 colors, which can be mixed to provide still more shades. For use on wood, dissolve the all-fabric type of dye according to the directions on the box. Brush or wipe it on, let dry, apply white shellac, sand lightly, and finish with clear varnish.



6. Block Insulates, Too. Wall and insulation are combined with the Thermoflector masonry block. It comes with insulating strips of aluminum foil that are slipped into the air cells as the blocks are laid.



7. Brush Bends into Corners. You twist the brush instead of yourself to paint in hard-to-reach corners with the Util-A-Brush. It has a flexible connection that lets the handle bend to any angle.

Further information on these products can be obtained from: 1. Perma Products Co., 5455 Broadway, Cleveland 27; 2. Daps Co., 71 Grove St., Paterson 3, N. J.; 3. Target Products Co., Box 276, West Boylston, Mass.; 4. Wall-Dec Co., 228 E. 45 St., NYC 17; 5. Park & Tilford Co., 485 Fifth Ave., NYC; 6. Thermoflector Corp., North Sioux City, S. D.; 7. Fern-Wey Co., 11705 Detroit Ave., Cleveland 7.

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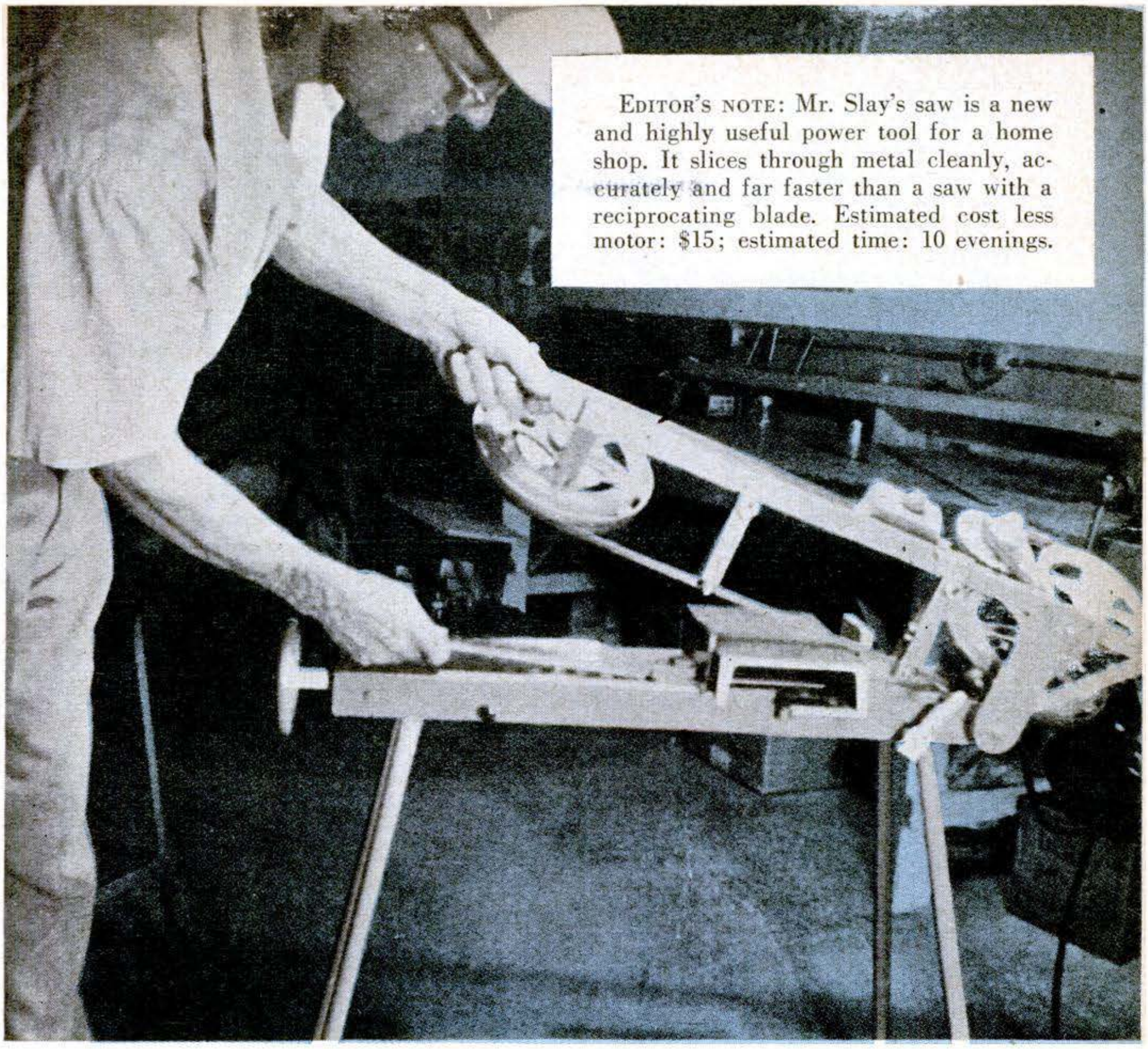

EDITOR'S NOTE: Mr. Slay's saw is a new and highly useful power tool for a home shop. It slices through metal cleanly, accurately and far faster than a saw with a reciprocating blade. Estimated cost less motor: $15; estimated time: 10 evenings.

Metal-Cutting Bandsaw Made from Old Lawn Mower

This rig takes the hack out of hacksawing. It will cut up to 6" channel without a squawk, quit when it's through.

By Willard Slay

NOBODY has ever convinced me that hacksawing is fun. I enjoy building metal projects, but cutting the stock always seemed the most tiring part of the job until I built this machine.

Now electricity furnishes the elbow grease, and I can watch the rig make short work of a lengthy hacksaw job. When the blade cuts through, the machine shuts itself off.

It all started when something—maybe a twinge in my hacksawing muscles—told me the wheels of an old lawn mower were just right for a metal-cutting bandsaw. Some 6" channel, bar stock, pulleys and the saw blade accounted for most of the cash outlay, which added up to $15 without the

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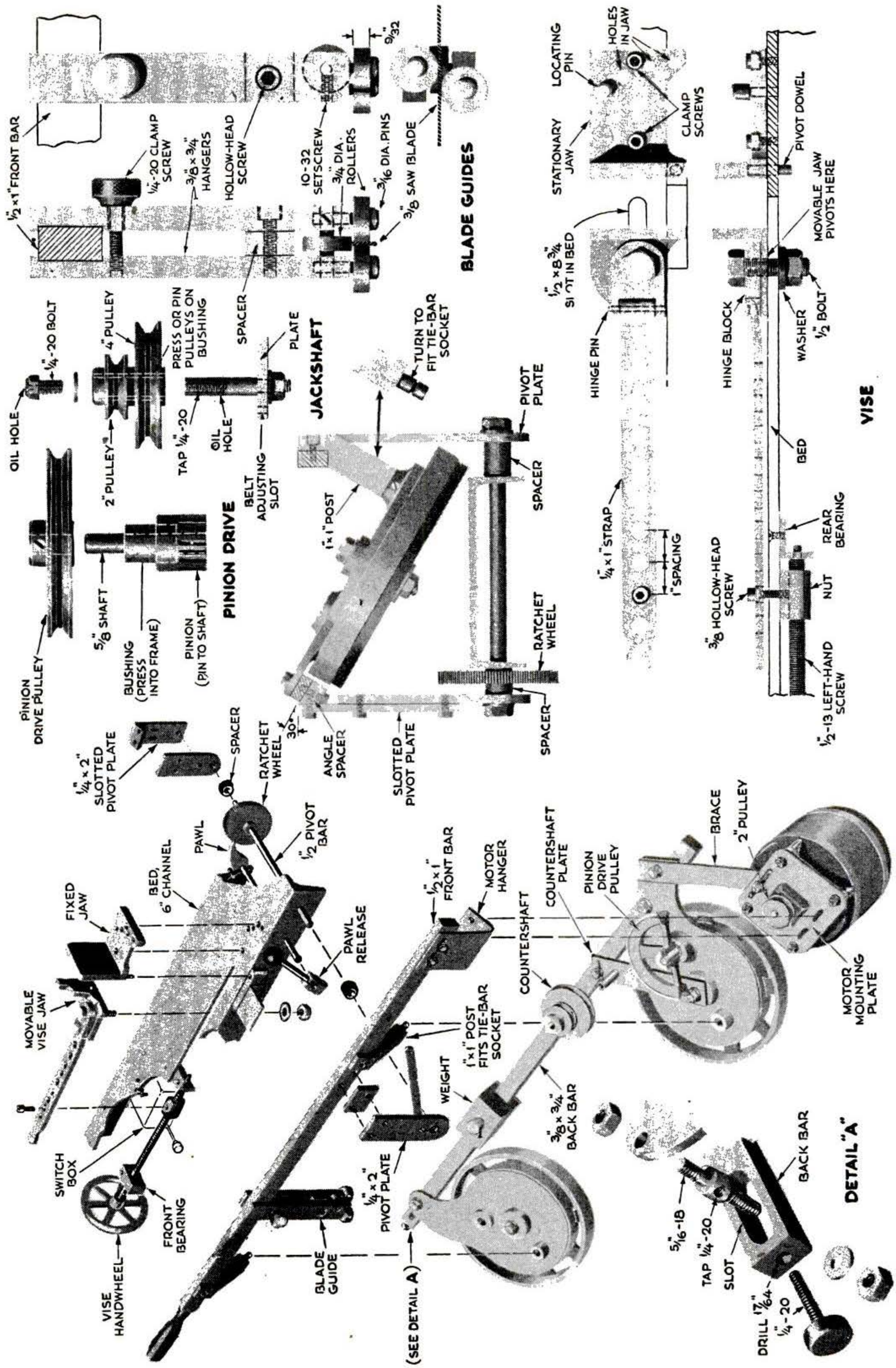

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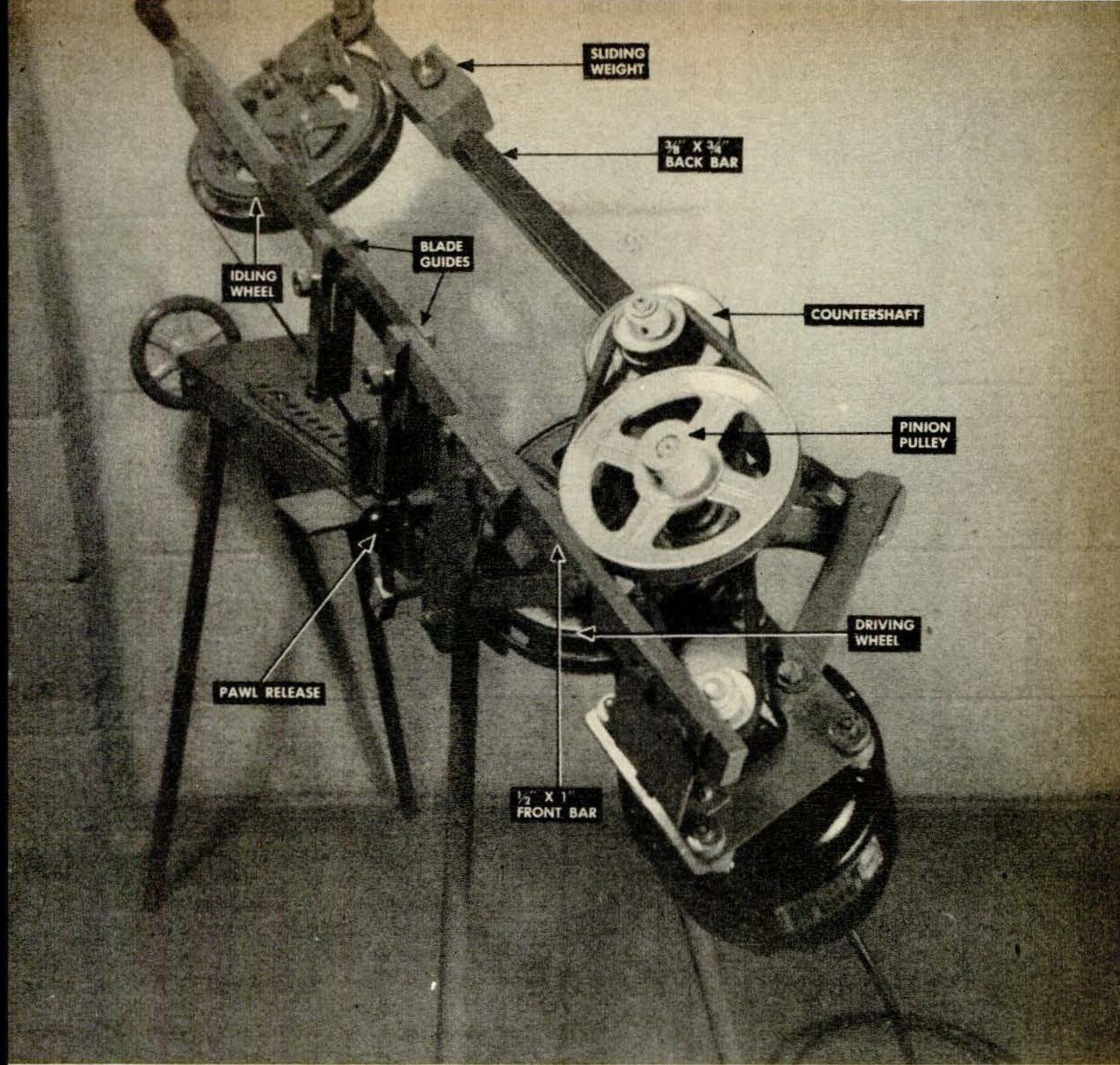


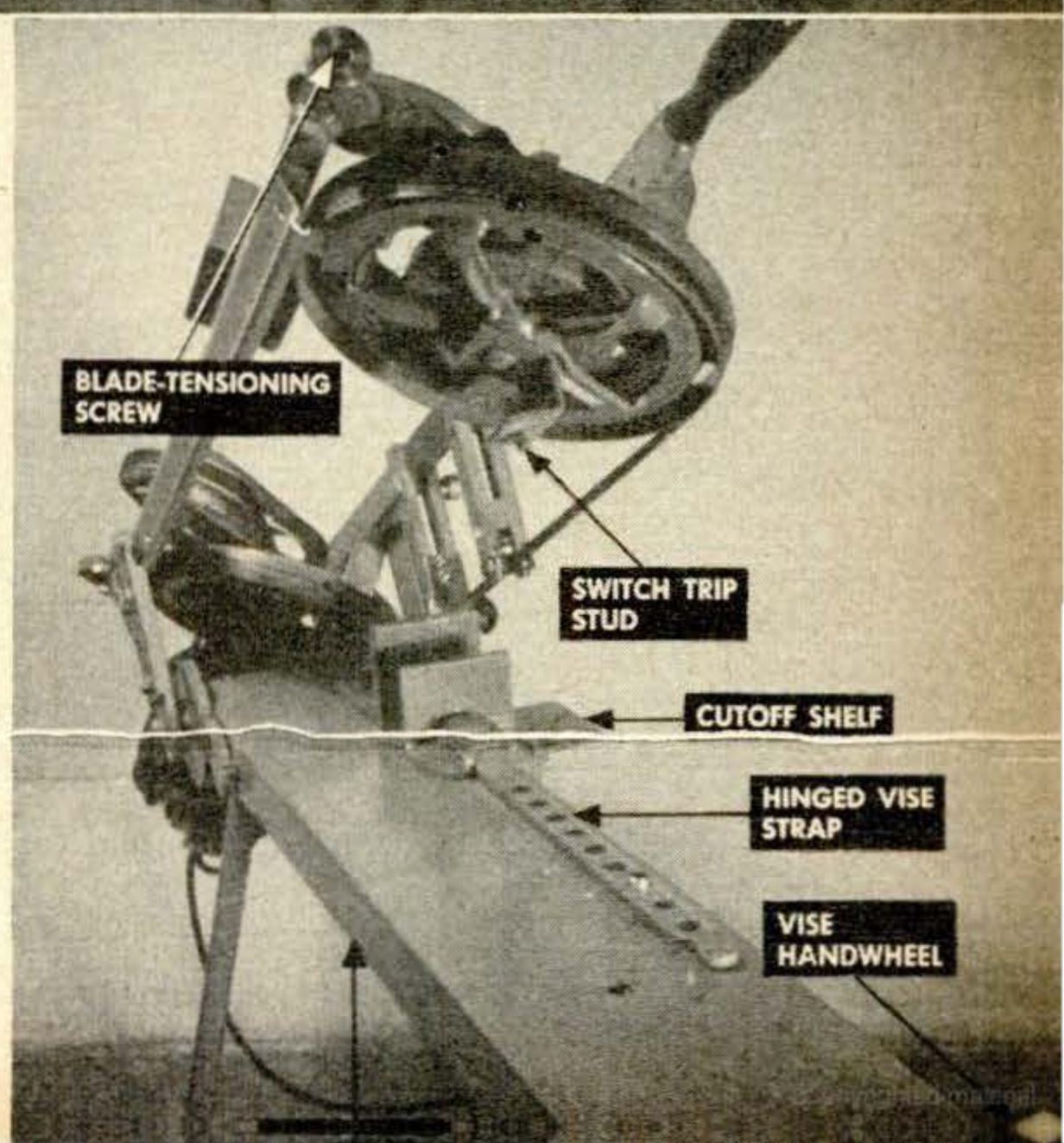
MOTOR COUNTERBALANCES weight of the saw frame, which is held in any position by a toothed wheel and pawl. Vise holds stock up to 8" wide; capacity under blade is 4". Wheel tilt puts return loop of blade above cutting line, so there is no limitation on work length.

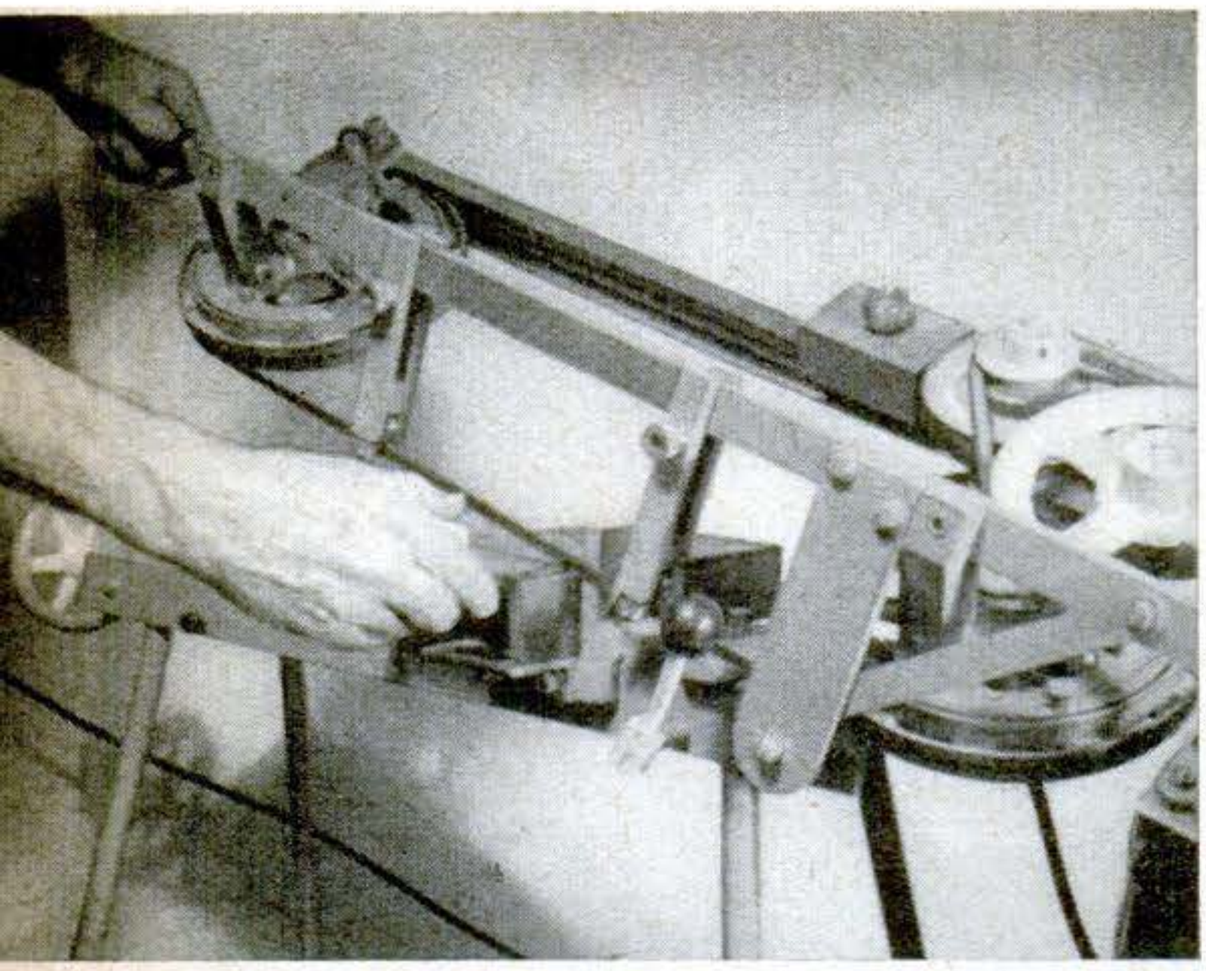
¼-horsepower, vertically mounted motor.

Turning the wheels. Since lawn-mower wheels vary in diameter, the length of the frame must suit them and the saw blade. Chuck each wheel from the inside with the hub running true. Then turn the periphery true, forming the blade seat and the reduced diameter that gives tooth clearance.

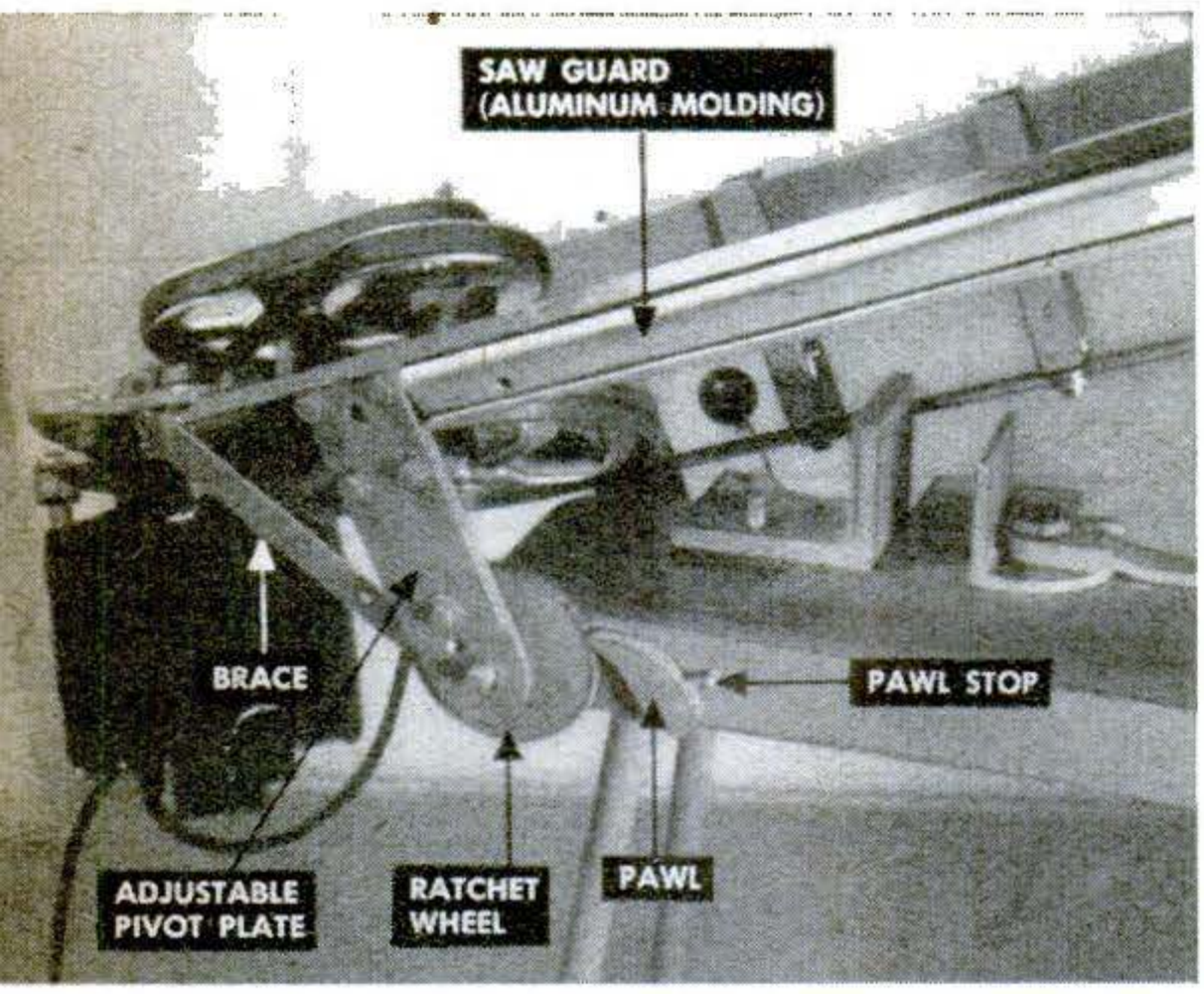
At the same chucking, bore out the hub for a bronze bushing and then bore the bushing a running fit on the frame bearing.

If you find wheels that have good roller





WITH WORK CLAMPED, guides are adjusted to span of cut, saw started, and the ratchet released so that blade can be lowered to start cut. Weight on back bar can be adjusted to increase saw pressure.



RATCHET lets saw tilt fully vertical. With an extra brace to hold it rigid, and a table clamped to bar, contour sawing could be done. Fixed vise jaw is held by two screws; these must be removed to swivel it for angle cuts.

bearings, turn a stub arbor to fit the bearing seat in the wheel, clamping the wheel on if necessary, and machine the rim.

The bed. This is 6″ channel with pipe legs welded on. It is slotted for the ½″ bolt through the movable vise jaw, and for the screw carrying the vise nut. Two holes across the bed take the pivot shaft on which the saw frame tilts and a rod that lifts a retaining pawl to hold up or release the frame.

Mounting the wheels. With the blade stretched over both wheels, measure the distance between centers and estimate the lengths of the frame bars.

The bars are mounted on ¼″-by-2″ support plates, which in turn are clamped on the ½″ pivot bolt with spacers and nuts. A block with one edge machined to 30° mounts the back bar at the same angle. Spacers on the pivot bolt match the spacing of the bars to the wheel frames.

At their lower end, both wheel frames are held on the front bar by posts of 1″-square steel. These are turned down at one end to fit into the original tie-bar holes in the mower frames. The other ends are notched at 30° so that the front bar is vertical.

At the top, the wheel frames are bolted to the back bar through the bed-knife hanger holes. The front or idler wheel is adjustable for tensioning the blade. It is supported on a turned stud that can be clamped against the back bar by two nuts. A tensioning screw through a tapped hole in the stud bears against the back of the slot.

Driving the blade. Power is applied to the rear wheel only, through the original pinion and internal teeth. The pinion is chucked and the pawl catches bored out to make room for the shaft bushing. This is pressed into the frame and extends into the pinion to provide a long bearing surface.

A countershaft is made by pinning or pressing two smaller pulleys on a common bushing, which spins on a stud. This is mounted on a support plate held on the wheel axle bolt at one end, and by a bolt through the back bar at the top. A slot here permits adjustment of the second V belt.

With mower wheels machined to 8″ in diameter, the pulley sizes shown drive the blade at about 100 feet per minute. For other wheels, use pulleys that will give this speed.

Blade guides. Each is made of two pieces of ⅜″-by-¾″ bar, milled or filed to fit around the front bar. The rollers should be hardened. They are mounted on 3/16″ pins retained by hollow-head setscrews.

Quick-acting vise. A left-hand screw mounted under the bed in two bearings turns in a block nut retained by a ⅜″ bolt that passes through a slot in the bed. A steel strap with a number of holes in it is dropped over the bolt at the approximate spacing to accommodate the work, and the vise screw is then tightened to clamp it. The movable jaw swivels under the hinge block for holding work at an angle.

The fixed jaw can be turned on a dowel pin for angle cutting. A second dowel pin is dropped into corresponding holes to locate the angle desired quickly. END

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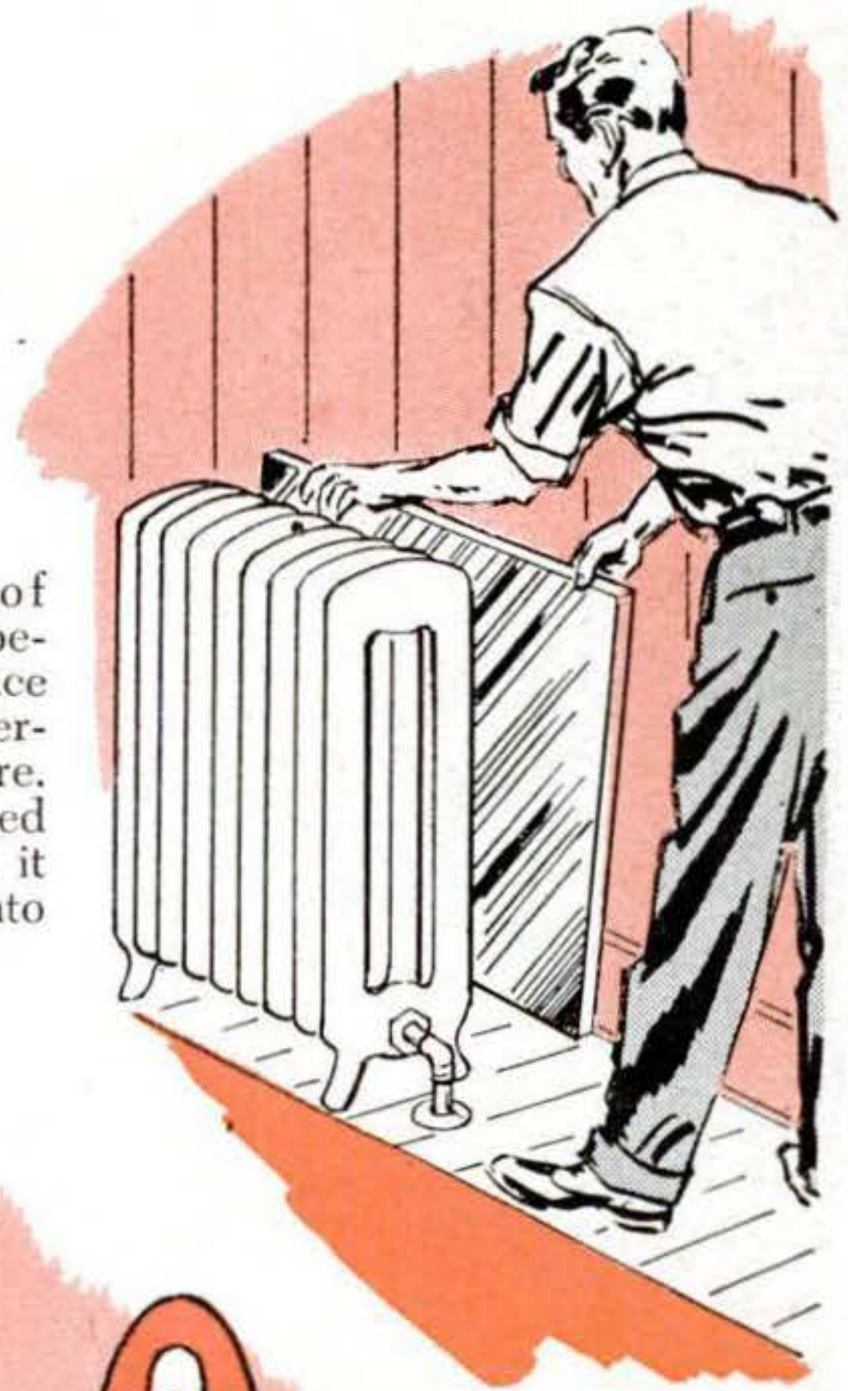
KEEPING THE *Home* SHIPSHAPE

To see what cooks by fluorescent light, say the experts, use a shielded fixture with a 25- or 40-watt tube and mount it over the stove with the lower edge of the fixture no more than 58" above the floor.

Fancy tacks in upholstery sometimes work loose and are lost. When covering furniture, press leftover tacks into the wood beneath the piece and you'll have replacements if needed.



Heat reflectors of aluminum foil set behind radiators bounce out heat that otherwise is pocketed there. If the foil is stapled to a window screen, it is easy to slide into place.

A narrow base cupboard that slides out like a drawer is handy for floor wax, furniture polish, soaps and cleaning supplies. In a bedroom, it could be used to hold shoes.

A steel crochet needle filed to a point after the hook has been removed makes an excellent cooking tester for the kitchen or a good awl for the shop.

Please turn the page for more new ideas.

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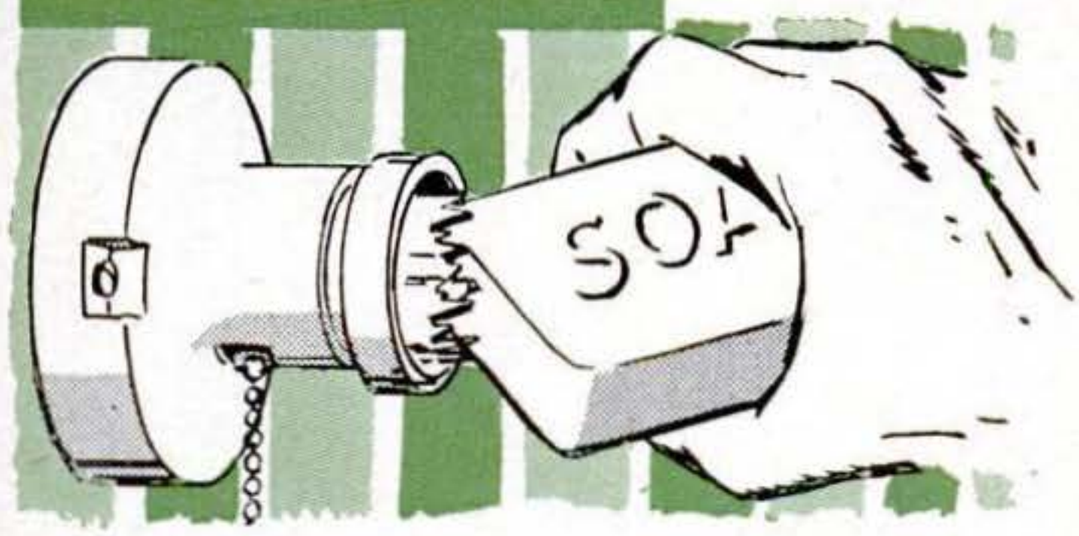
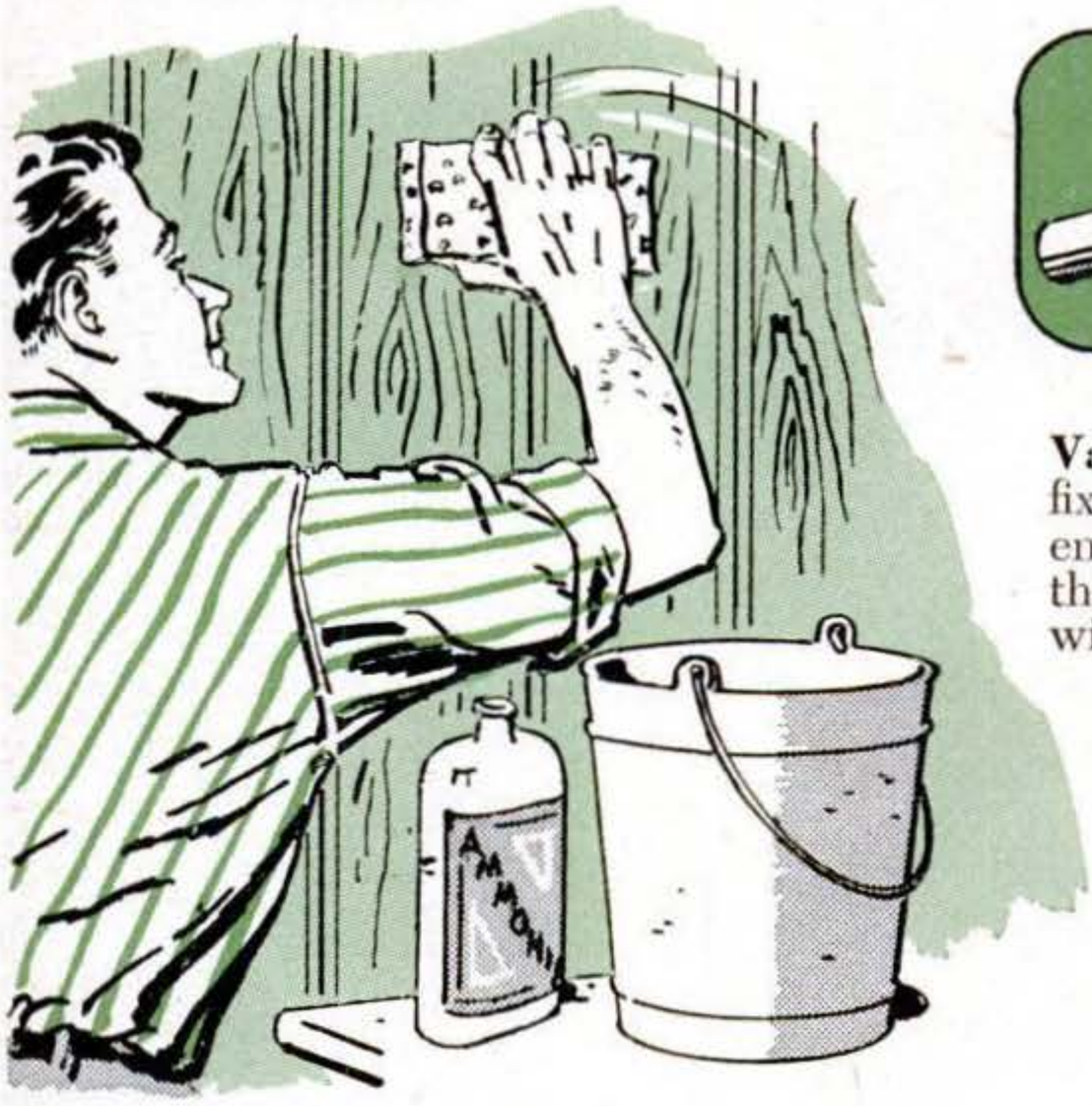
MORE HOME TIPS



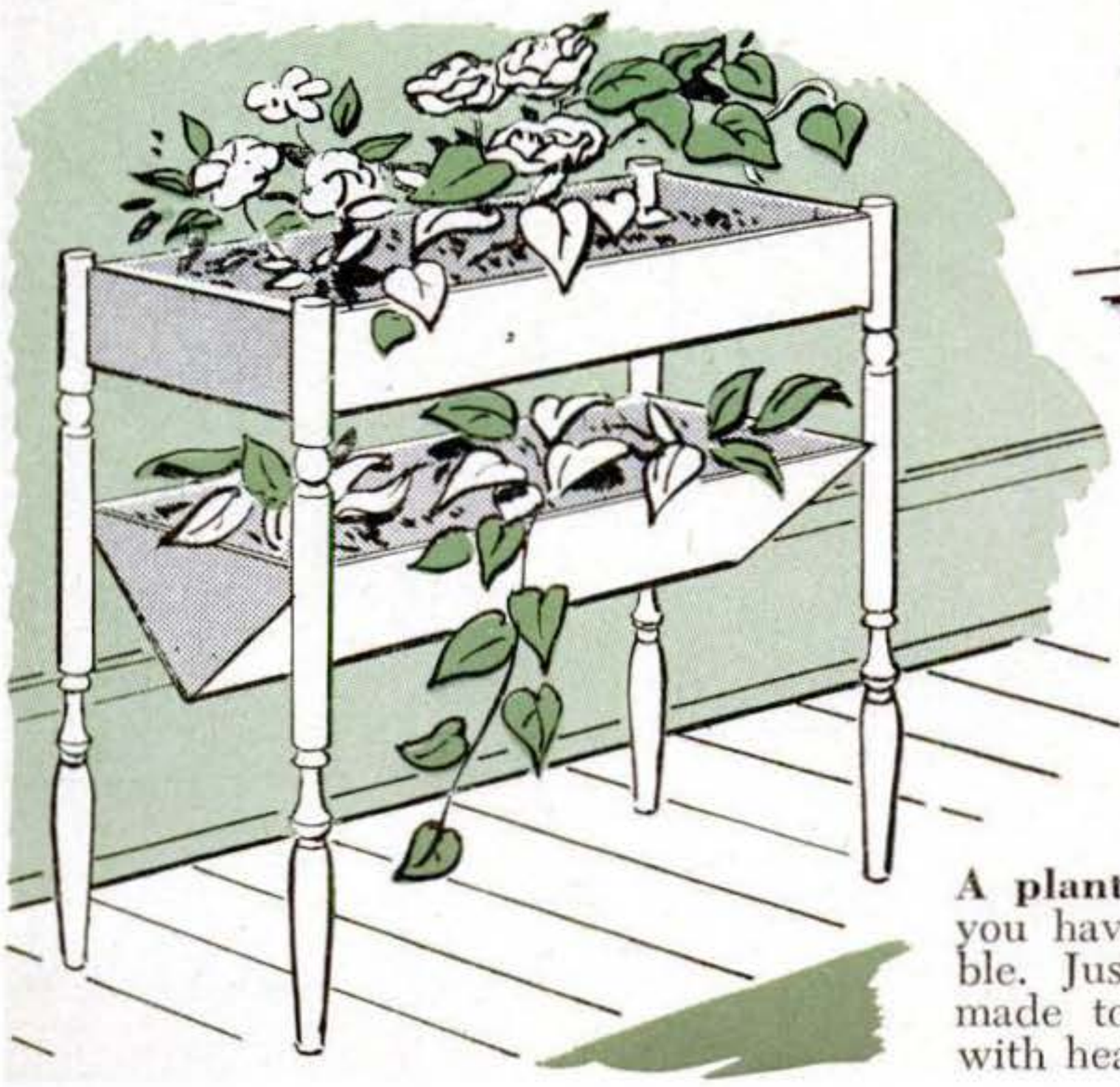
A bar of soap pressed into the broken ends of a light bulb makes a handle to turn it out of the socket. Before starting the job, turn off the current.

Vacuum hose working loose? Free it from the fixture, cut off any frayed portion and wrap hose end with friction tape. Oil tape lightly, reinsert the hose and tap in two curved metal shims flush with the rim to tighten assembly.



To get an antique look on knotty-pine woodwork, sponge the surface with a fairly strong solution of ammonia or soda to "age" it. Then apply two thin coats of clear shellac.

Store hardware in coffee cans and they can be stacked to take up little space. Samples dropped through slits, as shown, make it easy to identify each can's contents.



A plant stand is already half made if you have an old trough-shelved end table. Just replace the flat top with a box made to fit. Line the box and trough with heavy foil.

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Will Your Mower Start Next Spring?

Service it before you put it away. Then you can be sure it will be ready to go when the grass sprouts again.

By Howard G. McEntee

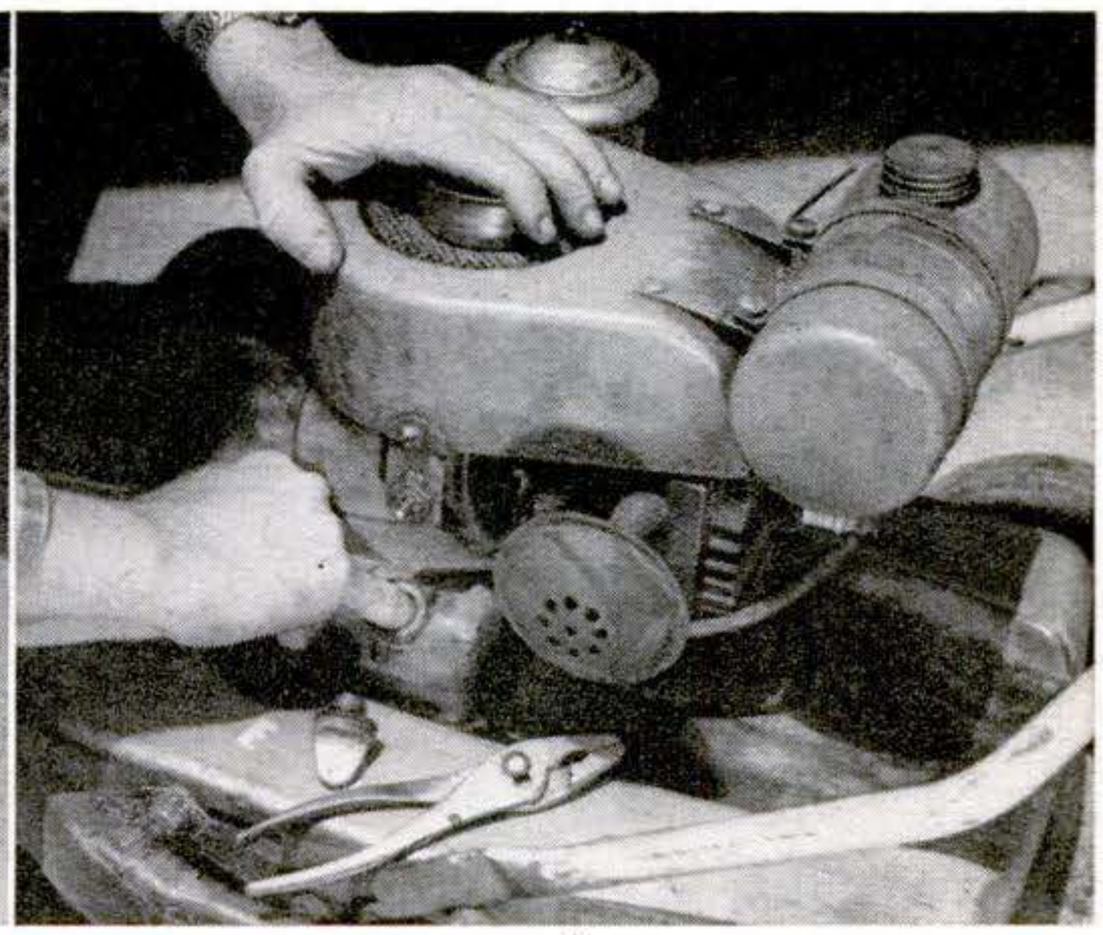
IF A power mower is in working shape when grass cutting ends, you can easily make sure it will go into action right along with the buds next year. It all depends on what you do before shoving the machine aside for the winter. Care now can save you hard work and annoyance in the spring.

To do this lay-away job right, you'll need a can of white (unleaded) gas, some kerosene, engine oil, auto-chassis grease, a few wrenches, a screwdriver and pliers. A couple of empty cans and plenty of clean rags will come in handy too.

Of course, all points with oil cups or grease fittings should be lubricated. Follow the instruction manual if you have it. Lubricate wooden rollers by blowing graphite lubricant in (oil collects grit that will wear the roller rapidly). Wipe the cutting edges with chassis grease to protect them against rusting. Store the mower in a dry place until next season.

IF YOURS IS A FOUR-CYCLE ENGINE...

First run engine with gas valve shut or tank drained to empty carburetor. Remove cap of oil-bath air cleaner, take out filter, pour out old oil and wipe bowl (above). Fill with new oil to indicated level and reassemble. (See page 230 if yours is a dry or an oiled-filter type.) Drain gas tank completely and wipe out sediment bowl if system has one.



Drain crankcase and insert finger or stick. If there is sludge at the bottom, pour in a half-and-half mixture of kerosene and oil. Rock engine back and forth to loosen dirt. Do not run it. Thoroughly drain off all flushing oil. Repeat if crankcase is still dirty. Then add new engine oil of correct grade until it flows out of the filling-plug opening.

Please turn the page for more about mowers.

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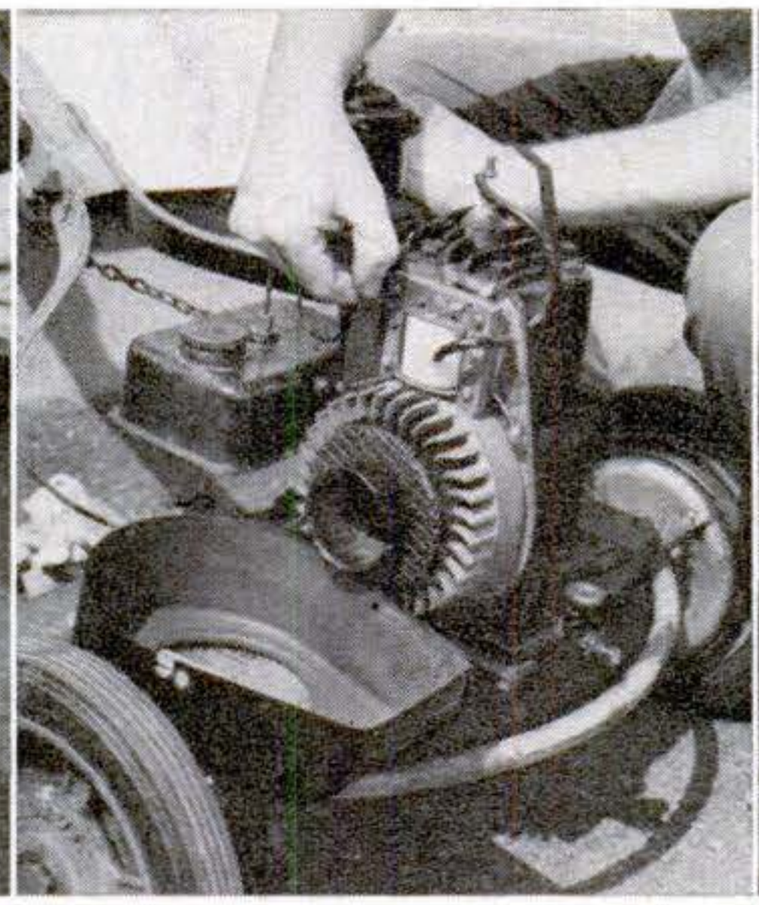
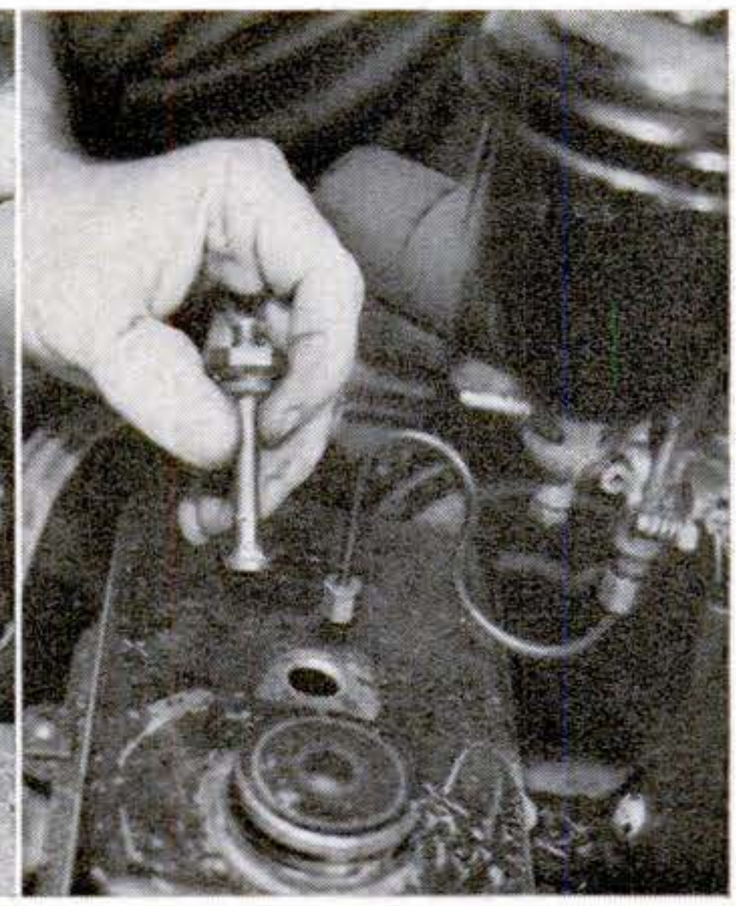
FOUR-CYCLE MOWERS (continued)...

Loosen spark plug with a well-fitting wrench. Scrape and blow dirt from around plug before removing it completely. Then pour a spoonful of engine oil into the plug hole and turn the engine over slowly several times to spread oil on cylinder walls. Never spin the engine fast with plug wire off. Have plug cleaned and regapped if necessary; then replace it.

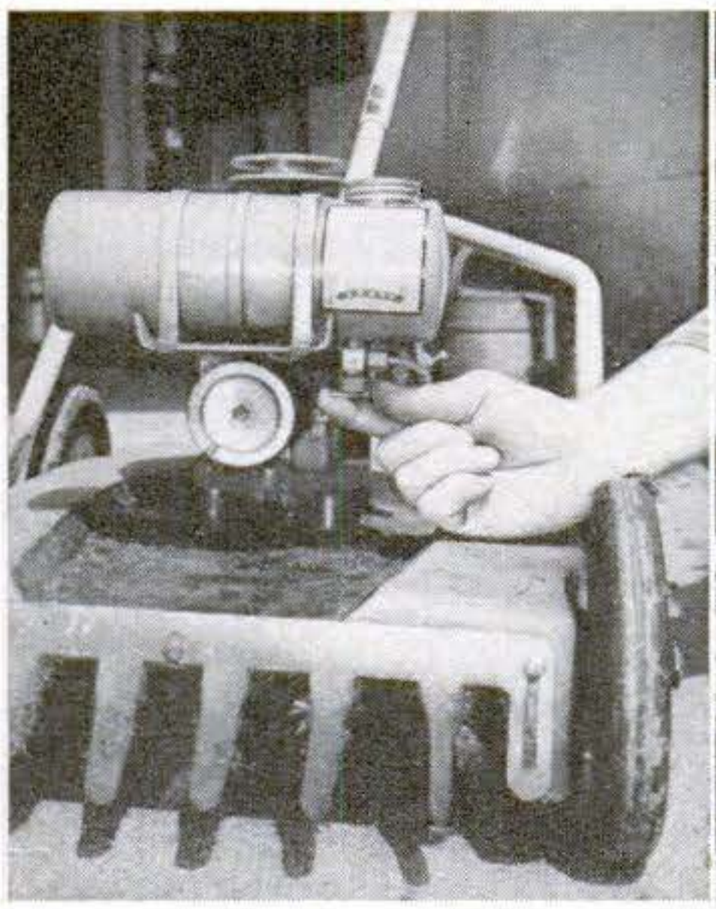


Remove blower housing. Clean out grass and dirt from inside it, from the screen and around magneto. If the engine has an air governor (a pivoted vane actuated by the fan stream and linked to the throttle) make sure it works freely. If not, disassemble and clean all bearing points. Check spark-plug cable for abraded or cracked insulation. Replace it if necessary.



Check suction feed (on gas tanks below carburetor) by unscrewing line and big nut on tank to remove fitting shown. Brush and rinse screen in gas. Test check valve, which keeps gas line from draining with engine idle, by trying to blow into top end. If you can, rinse and blow from bottom to dislodge any dirt. If valve still leaks, a new one will ease starting.

IF YOURS IS A TWO-CYCLE MACHINE...



Close gas valve and run engine until it quits. Gas-oil mixture causes clogging if left in over the winter. Also disconnect gas line and thoroughly drain tank, tilting the mower if necessary. Float carburetor may hold gas even after engine stops. Remove screw or entire bowl to drain it. Blow through gas line and replace it. Clean out sediment bowl if there is one.

Dip dry air filter in clean unleaded gas, using a toothbrush if necessary to dislodge dirt. Such a filter, usually a porous cylinder of treated paper, should not be oiled. Metal-wool or fiber-wool filters are oiled to catch dirt as air passes through. Rinse this kind in gas. Shake the filter element dry. Then dip it in engine oil. Set aside to drain thoroughly before replacing.

Scrape carbon out of the engine exhaust port and muffler. On some two-cycle engines, the muffler comes apart to make this job easier. Accumulated deposits here can cause back pressure and loss of power. The mower shown has its exhaust underneath, so the rotary knife had to be removed for access to muffler. A pocket knife can be used for scraping out the carbon.

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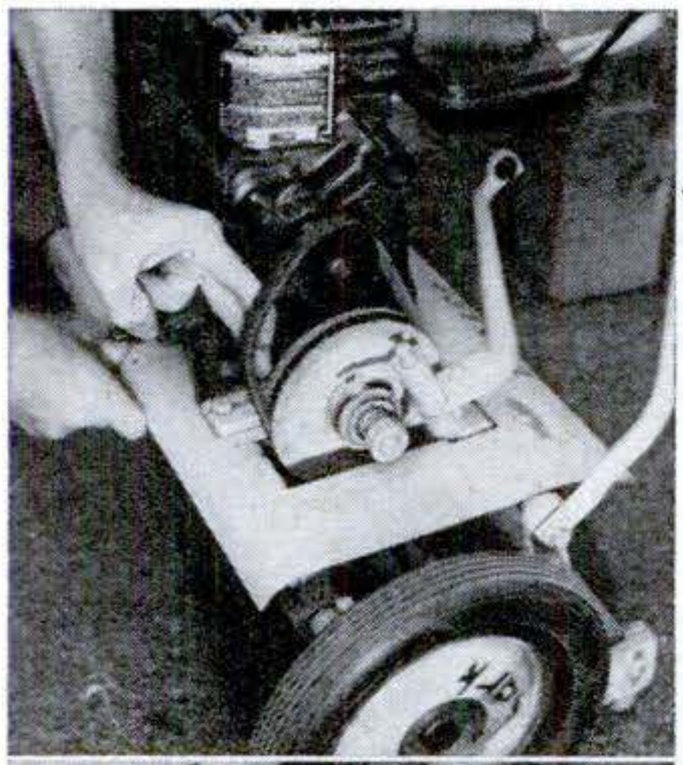
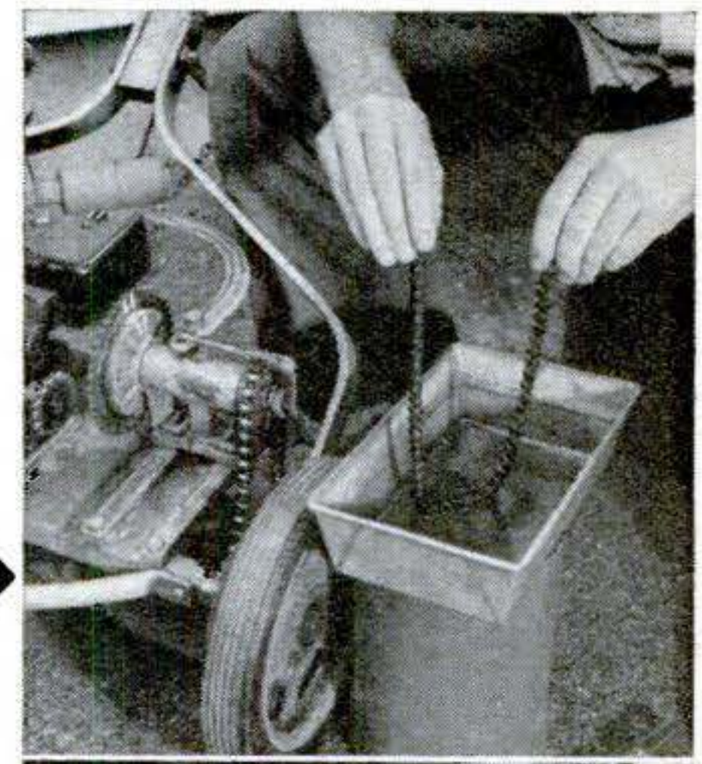
SERVICING THE MOWER MECHANISM

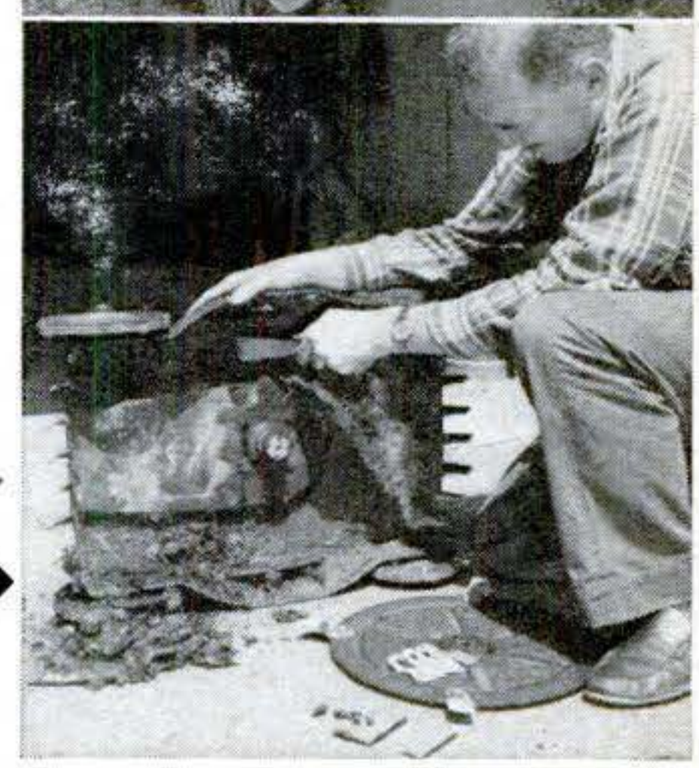


Check V belts. This one is slack and will slip under load, wearing both itself and the pulleys. Moderate finger pull should draw belt only about ½" out of line. Loose rubber or cracks are signals for belt replacement.



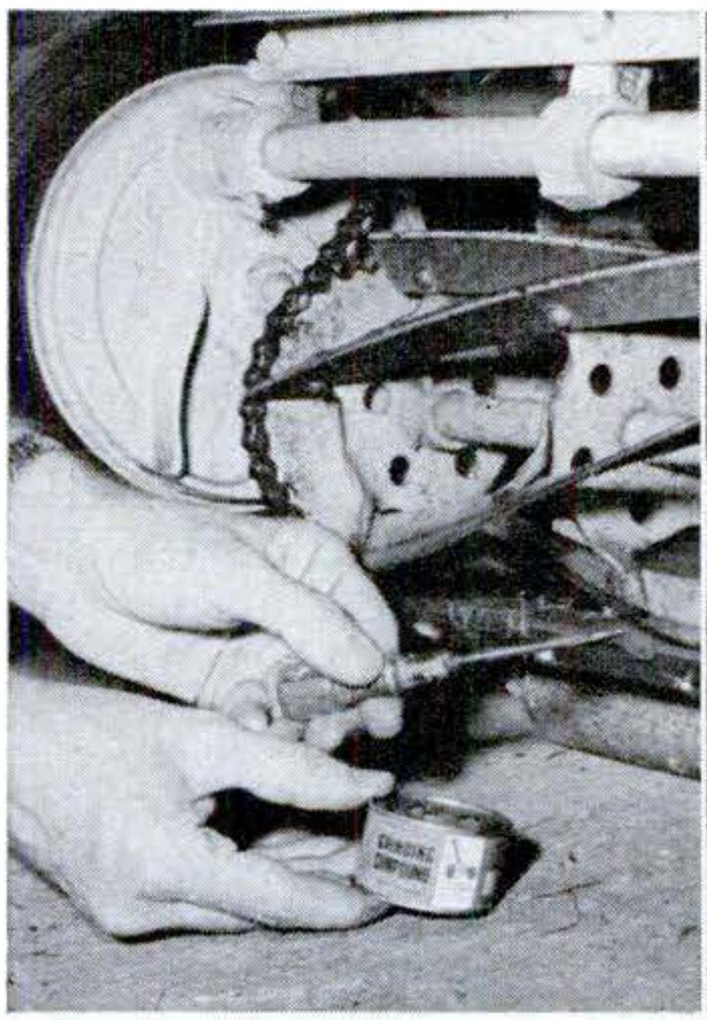
To clean chains, snap spring clip off removable link. Mark nearest tooth and slide link out. Rinse chain in kerosene, wipe dry and soak in oil several hours. Wipe thoroughly. Replace chain exactly as it was.

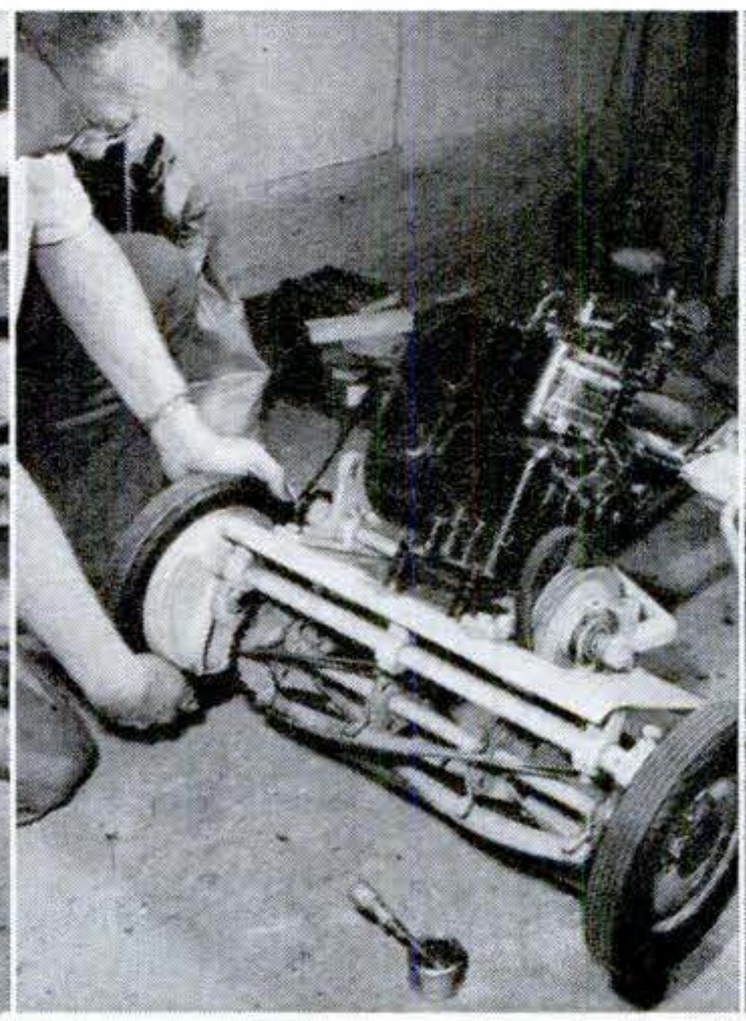
Remove wheels, some by pulling cotter pin, others by unscrewing nuts (left one may be left-handed). Clean gear teeth, pinions and pawls. Grease and reassemble. Don't swap right and left pinions.



Scrape caked dirt and grass from under rotary mower with a putty knife. Oil the wheels. See whether rotary knife has nicks and resharpen if necessary. Mower at right has individually replaceable blades that are bolted to the big disk.

HOME LAPPING MAKES SHARPENINGS LAST LONGER





Sharpening reel mower is a job for the expert. But you can keep blades sharp longer by lapping when they begin to dull (not oftener). Smear valve-grinding compound evenly along bed knife (left above). Block up mower and turn reel backward. On mower shown (center) wheel could be turned by hand with drive belt off and clutch engaged (fork tension made load too heavy with clutch disengaged). Maker sells an extra sprocket (right above) that runs chain on outside of drive sprocket to make engine turn reel backward. Another manufacturer offers a crank for lapping. Advance bed knife very slightly by means of regular adjusting screws as lapping progresses. Be sure to get off every trace of abrasive when finished. Check contact of reel with bed knife by inserting paper. Pulled, it should indicate drag without tearing. Repeat test all along bed knife. Turned, reel should cut paper cleanly. END

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How to See a Ghost

Your eyes can play tricks on you in many ways. Retinal fatigue explains this one.

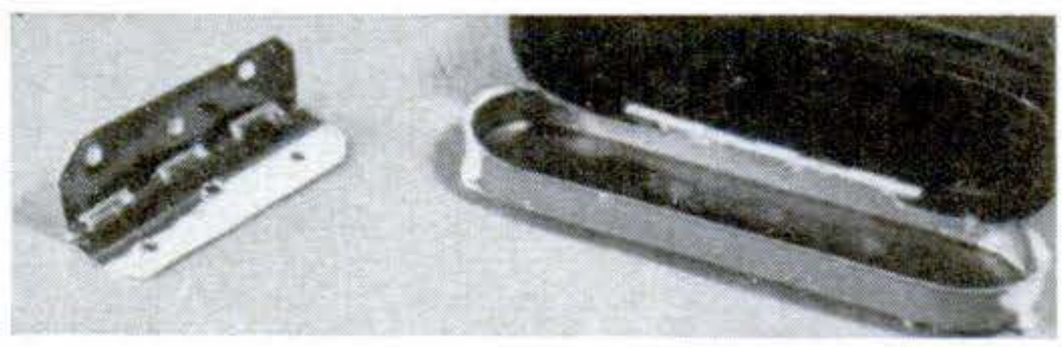
ENTER any darkened room with the magazine that is now in your hands. Turn on just one light, preferably a gooseneck desk type like the one you see below. Grasp the magazine firmly, open to this page and thrust it into the full glare of the light. Then stare intently at the black ogre above. Do nothing else. Just relax and look at the ogre for a half-minute or more.

Suddenly switch your eyes away into the darkness—and you'll see the ghost, a shimmering white replica of the black specter you have been looking at. For the next few minutes, the apparition will haunt you wherever you look. You won't be able to dispel it even by closing your eyes.

Such tricks of vision are caused by what psychologists call retinal fatigue. The black image you see when you shift your eyes away from a TV screen is explained the same way. When you have looked at the bright screen for several minutes, that part of the retina on which the light falls becomes tired. When you look away, the tired area responds more feebly to the light in the room. Your eyes conjure up a dark, rectangular after-image.

In watching TV, the constant fluctuation of your eyes from the bright screen to the darker areas around it causes fatigue. It is best to have the region around the set moderately illuminated.—*Kenneth M. Swezey.*

Tobacco-Can Top Makes Hinge



Simple hinges for small projects can be cut from discarded pouch-type tobacco cans. Use tin snips or heavy shears, leaving about ½" of metal on each side. Then drill or punch holes for mounting screws.

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It's the sportsman's movie camera

Little film stretches a long way

Uses economical 8mm. roll film with easy, no-thread loading. Enough film in each roll to shoot 30-40 average-length movie scenes!

Movies, rain or shine

Your choice of an f/2.7 lens . . . plenty fast for cloudy-day shooting . . . or a super-speed f/1.9 job that can see in the rain. Both Lumenized (hard-coated), of course.

CINE-KODAK RELIANT CAMERA

With f/2.7 lens, $89.50

With super-speed f/1.9 lens, $110

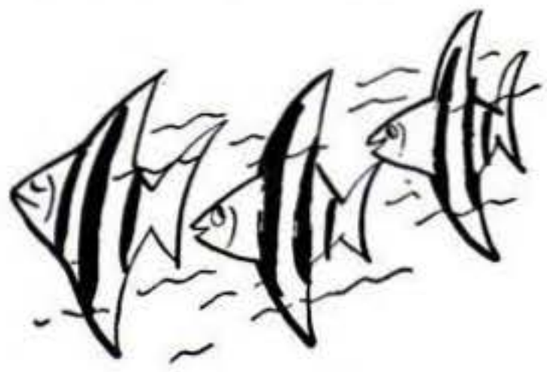
Other Kodak movie cameras, from $39.75 . . . at your Kodak dealer's. Prices include Federal Tax and are subject to change without notice.

Slows fast action

Really cuts fast action down to size. Use slow-motion setting with any film, either lens, for those extra detailed effects.

Built to take it

Rugged die-cast aluminum body. Your "Reliant" thrives on rough going — yet it's sweet-running as a custom-made reel.

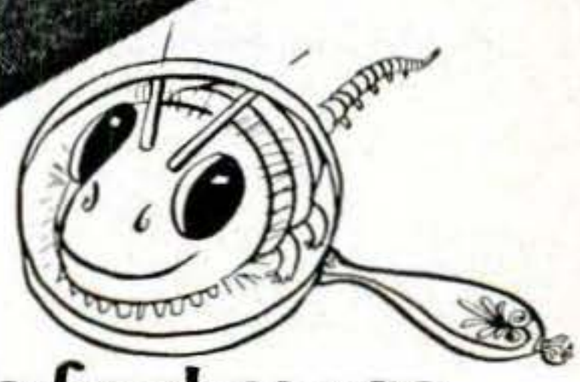


Takes color shots, too

"Reliant" movies are easy and inexpensive. Kodachrome movie film costs but $3.95 a roll (8mm.) — *including processing!* (Only $3.25 for black-and-white.)

Exposure guide knows the answers

Built-in exposure guide takes out all the figuring, leaves only the fun . . . makes sure exposure's right every time!

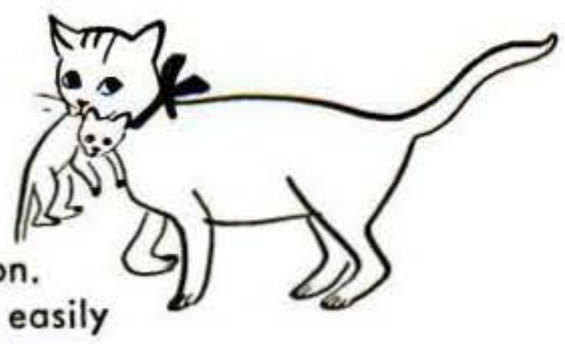


Telephoto for close-ups

An accessory lens magnifies 3 times to let you come up close on those hard-to-reach shots. View finder shows fields for standard or telephoto lens.

A delight to carry

Light and compact . . . slips in a jacket pocket ready for action. Swings and points as easily as your own 12-gauge.



See "Photographic Equipment and Supplies"

Eastman Kodak Company, Rochester 4, N. Y.

"LET'S MAKE MOVIES" A free and fascinating booklet that tells how to make color movies . . . how to make movies indoors as well as out . . . how to choose the right camera for your needs. Just fill out coupon and send to Kodak.

Dept. 6: Please send free copy of "Let's Make Movies" to—

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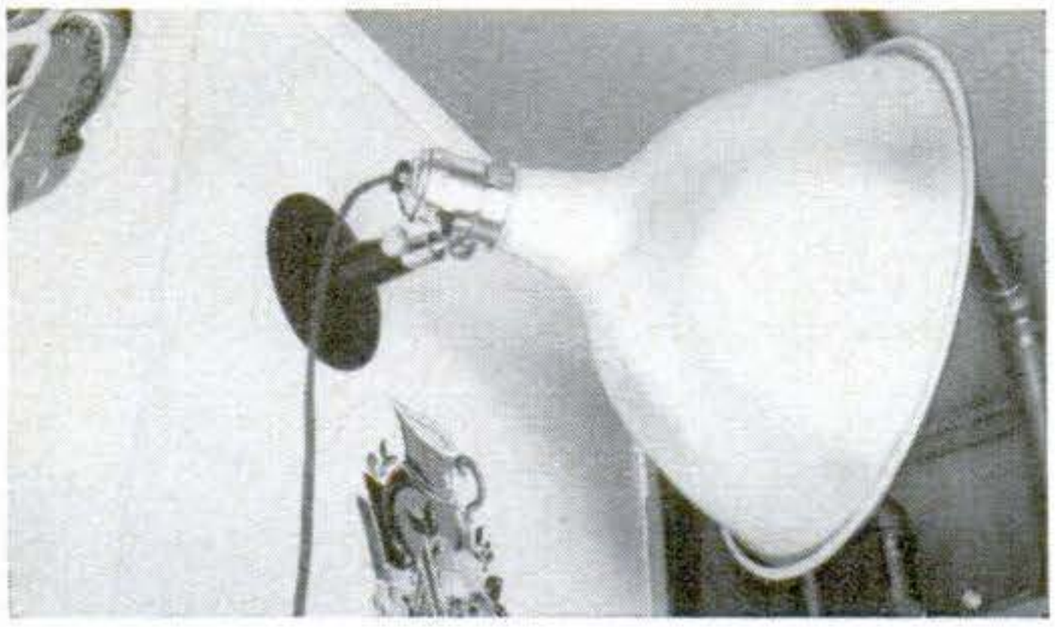
Kodak

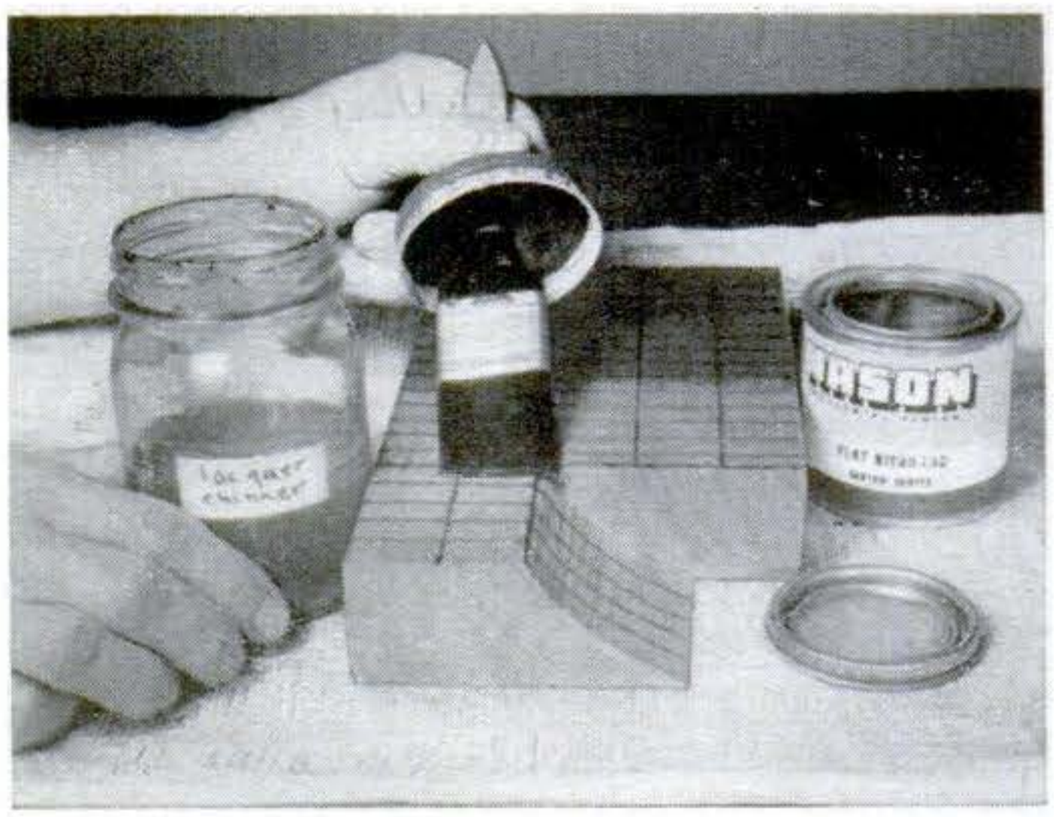
TRADE-MARK

Coffee Cans Make a "Dumbbell"

THE kids wanted to play weight lifter. With two coffee cans, a dowel and some cement they can.

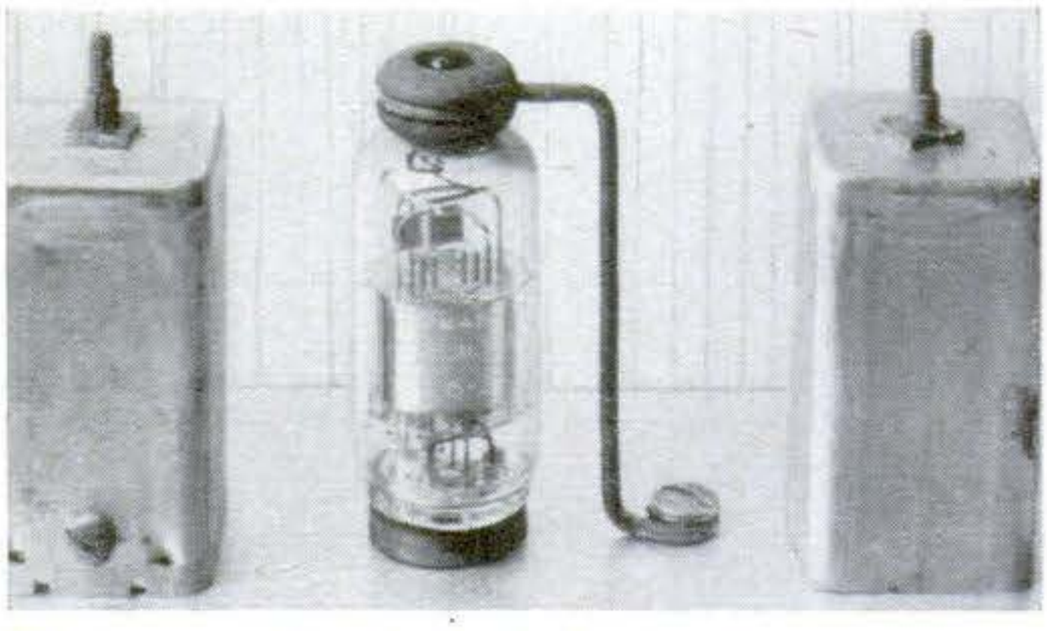
Nails were driven through the dowel ends where they would later be embedded in cement. Then the coffee tins were nailed to the dowel. With the dowel steadied in a vise and one can resting on a box, that can was filled with cement. When it had set, the dumbbell was turned over and the other can filled. The finished job weighs about 10 lb., just right for small fry.—*George R. Jones, Fresno, Calif.*





Often-Used Brush Kept Handy

IF YOU make frequent use of one finishing material, you can save a lot of clean-up time by setting aside one brush for that purpose and keeping it suspended in a jar of thinner. Pick a screw-top jar that is big enough, put a hole in the top for the handle, and line the top with rubber for a seal.—*Darrell Huff, Sonoma, Calif.*



Clamps for Miniature Tubes

THESE little clamps for miniature tubes cost about two cents each to make and take up little space. Just bend 14-gauge wire into a Z and shape an eye at each end. One eye fits the groove of a standard rubber grommet, the other takes a flathead self-tapping screw. When changing tubes, unscrew the clamp; do not try to bend it.—*Arthur Trauffer, Council Bluffs, Iowa.*

Vacuum Cup Holds Photo Light

A LARGE rubber vacuum cup—the kind sold in auto-supply stores—will hold your photographic floodlight to walls or other smooth surfaces where you cannot use clamps. Remove the ¼″ bolt that comes with the cup and replace with a short ⅜″ bolt—it will be held by the neck of the cup, not the original ¼″ nut. Cut off the bolt head and tighten the clamp on the shank.

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Spark Plugs That Perform **LIKE THIS** —

Will Make **YOUR CAR** Perform Better!

Official U. S. Air Force Photo

REFUELING IN FLIGHT, where plane speeds must be synchronized, presents a problem in engine operation that calls for flawless spark plug performance. Spark plugs engineered and manufactured by Champion—a prime supplier to the United States Air Forces—meet this exacting demand.

The Champions you purchase for your car are better spark plugs because of such challenges to Champion research, engineering and manufacturing facilities, all of which are devoted exclusively to the production of spark plugs.

So, try Champions in your car—you'll never again be satisfied with ordinary spark plugs.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Better by Far for **EVERY CAR** *Regardless of Make or Year*

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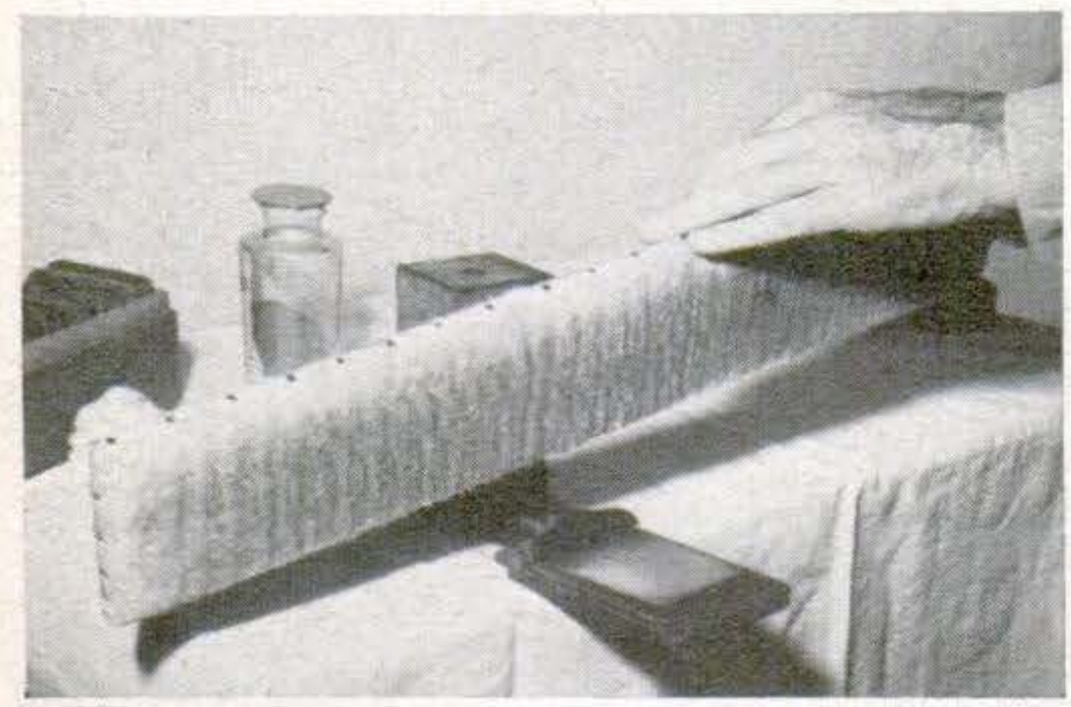
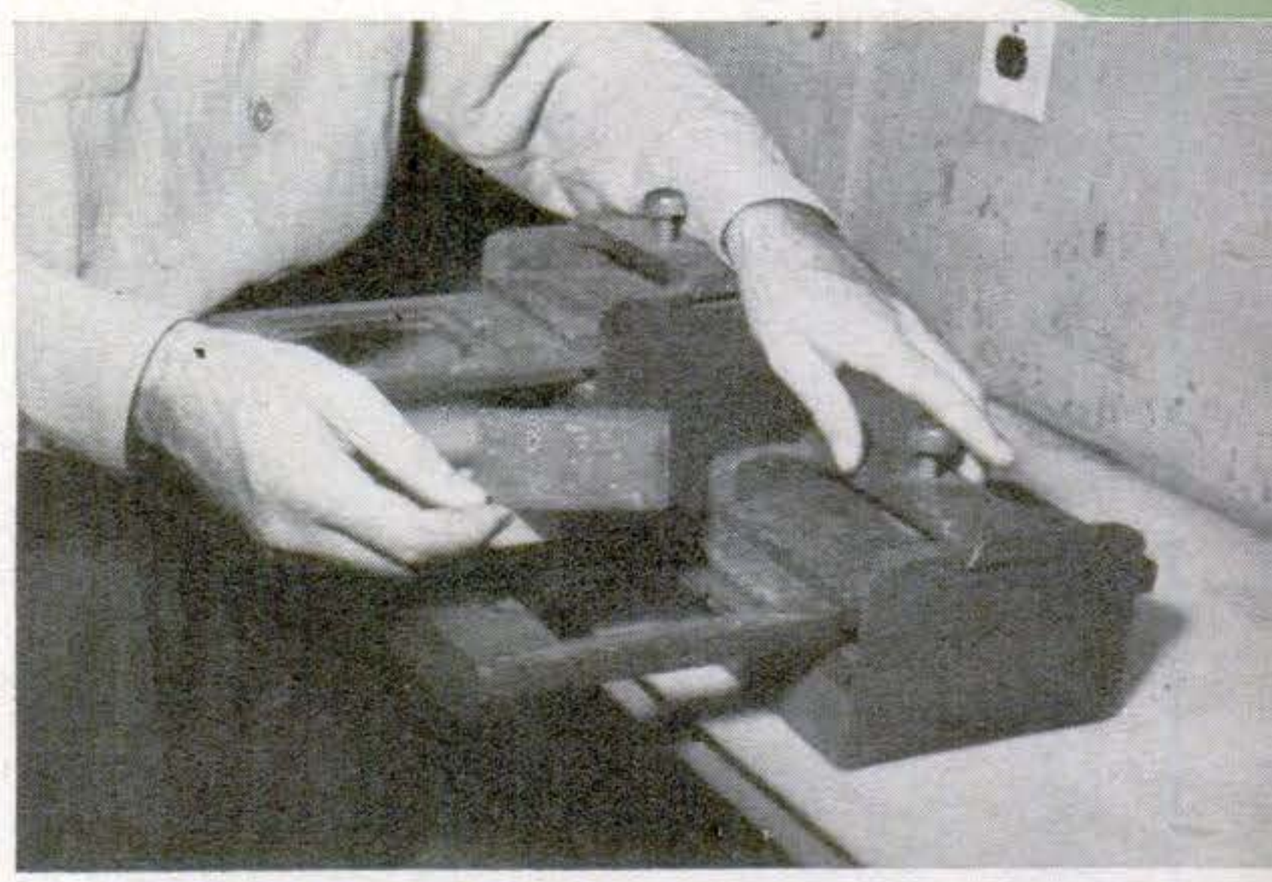
1 ROSEWOOD CAMERA obtained from antique dealer is used by Phillips. An 1850 model made in France, it has an f/5 lens without diaphragm or shutter. The exposure is made by removing the lens cap. Here, he shows how the plate holder (at left) is substituted for ground glass when picture is to be taken.

Almost-forgotten daguerreotype process—the direct-positive method used by photography's inventor a century ago—still makes good pictures.

2 PREPARING PLATE is tedious process. Plates are pieces of 18-gauge copper that have been silver-plated and polished. Just before picture is taken these must be polished again with alumina powder or rottenstone. Here, Phillips sprinkles rottenstone on a plate.



3 POLISHING CLOTH tacked to flat board is used for buffing plate. Made of cotton, this is smeared with red polishing rouge. If plate is to be used for a vertical picture, buffing should be done across plate to avoid light-reflecting lines. After treatment, plate is mirror-smooth and almost black.



4 PLATE IS SENSITIZED by putting it into a box containing an ounce of iodine crystals. In three minutes, vapor from crystals gives a yellow cast to surface. Plate then goes into a second box containing solution of bromine and chlorine. This turns surface violet. It then goes back into iodine box.

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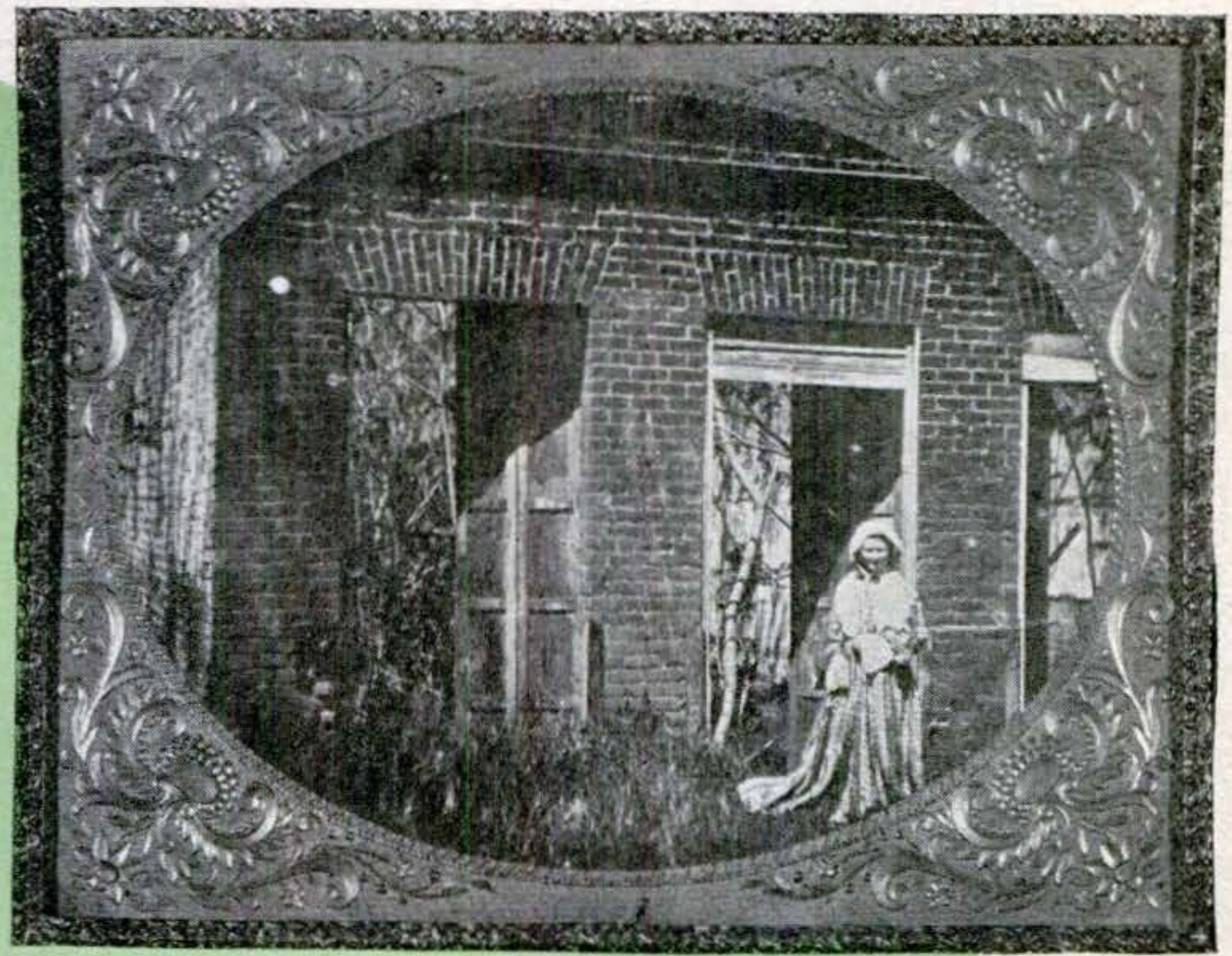
ANTIQUE SETTING. For this study, the model donned her grandmother's clothing and posed before the remains of a store built in Coloma, Calif., back in the gold-rush days.



SELF-PORTRAIT. A. R. Phillips Jr., Los Angeles insurance broker, used himself as the subject here. The frame is the ornate type found on old-time daguerreotypes.

Californian Masters Antique Photography

5 SENSITIZED PLATE is loaded into slide holder just as in modern photography. Rear view of camera shows how plate is inserted to make exposure, which may require up to five minutes.

6 DEVELOPING is done by exposing treated surface to fumes of quicksilver heated to 180°. Triangular box resembles inverted metronome. Vapor sticks where light hit. Plate is fixed in weak hypo.

7 FINAL STEP consists of covering plate with a solution of gold chloride and heating it from underneath. Heat causes the gold to leave solution and deposit on plate. This produces a sepia tone.

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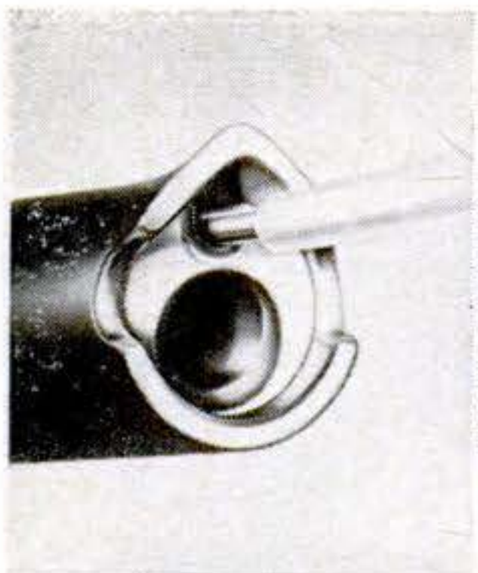
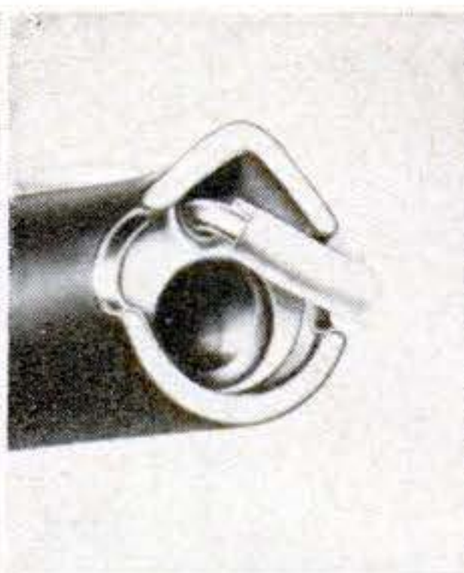
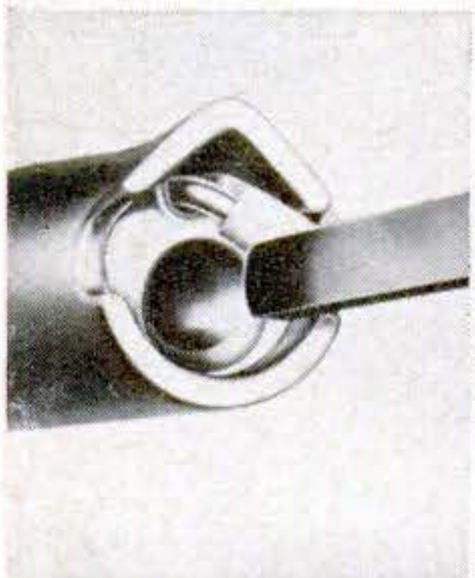


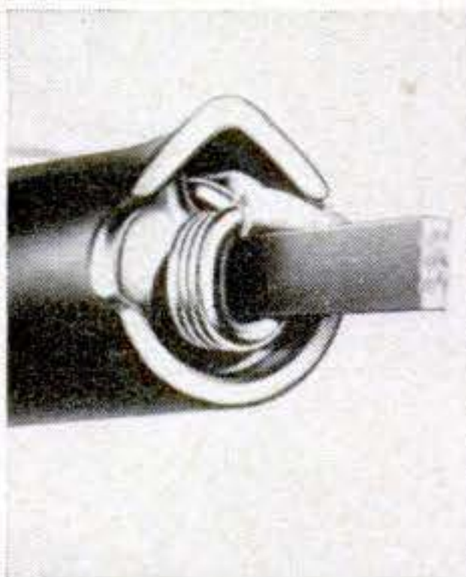
1 SKINNED END of wire is inserted into feed slot in tool tip.



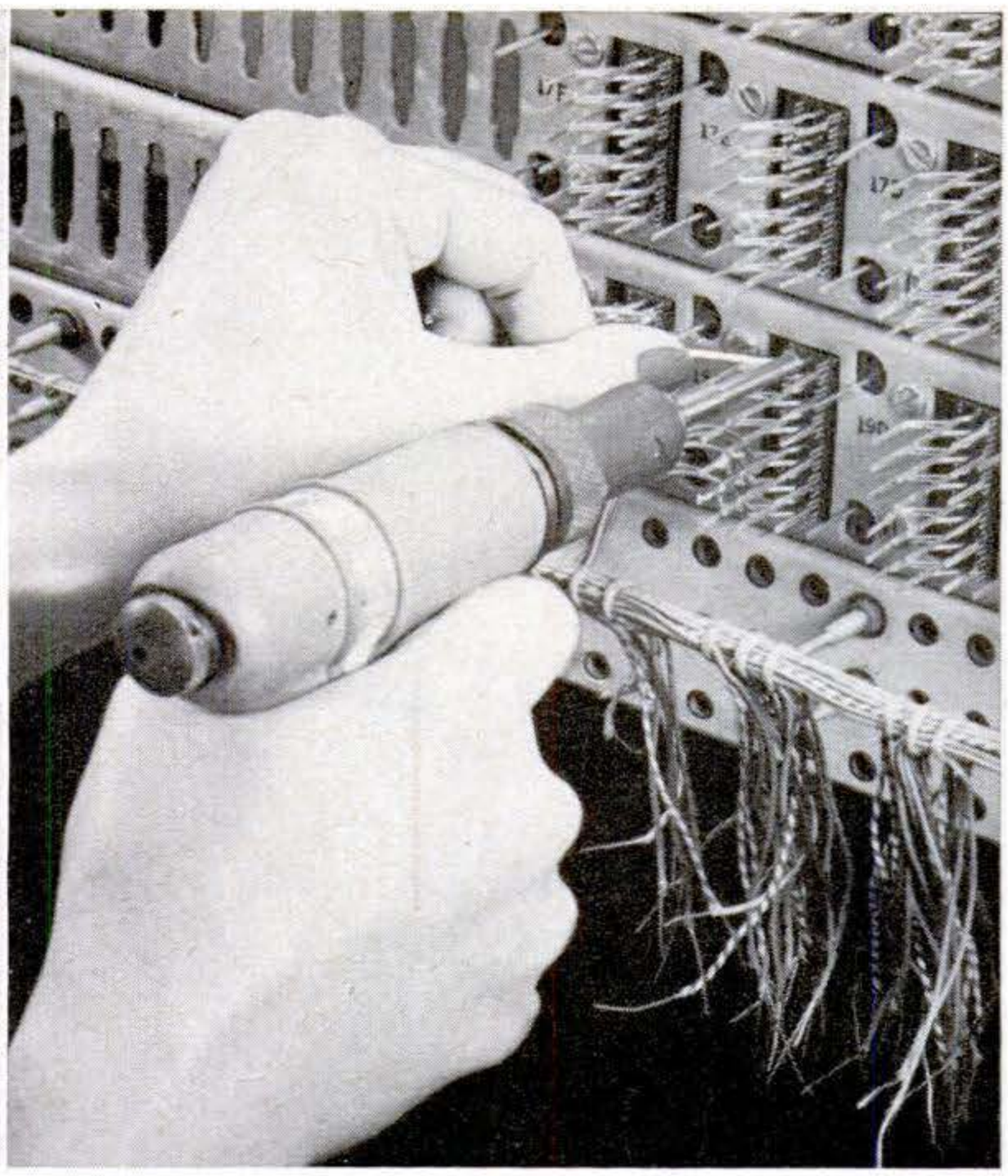
2 WIRE is hooked around anchoring notch to hold it for first turn.



3 TOOL is now pushed over the terminal (bar in picture above).



4 ROTATING SPINDLE twists wire (fed from slot) around terminal.

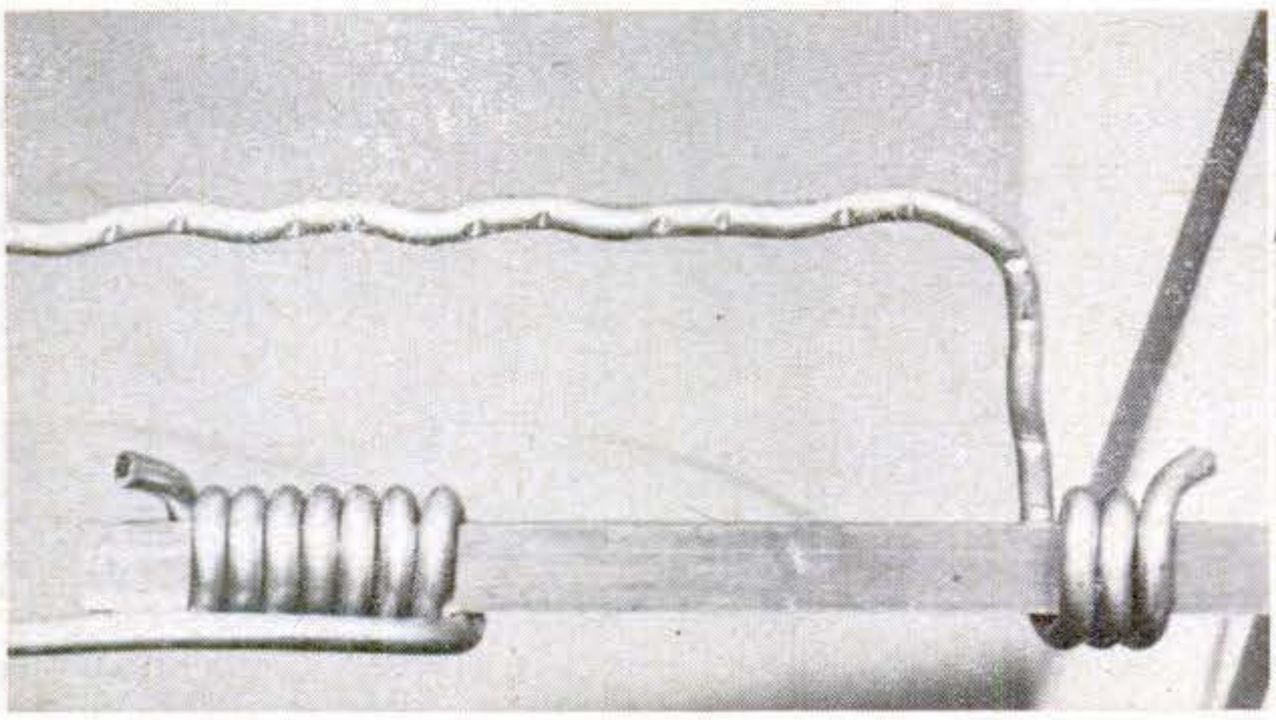


EASY-TO-HANDLE TOOL for connecting wires looks like an electric drill. This one is operated by compressed air. It was first developed for use with a phone relay that has closely spaced terminals.

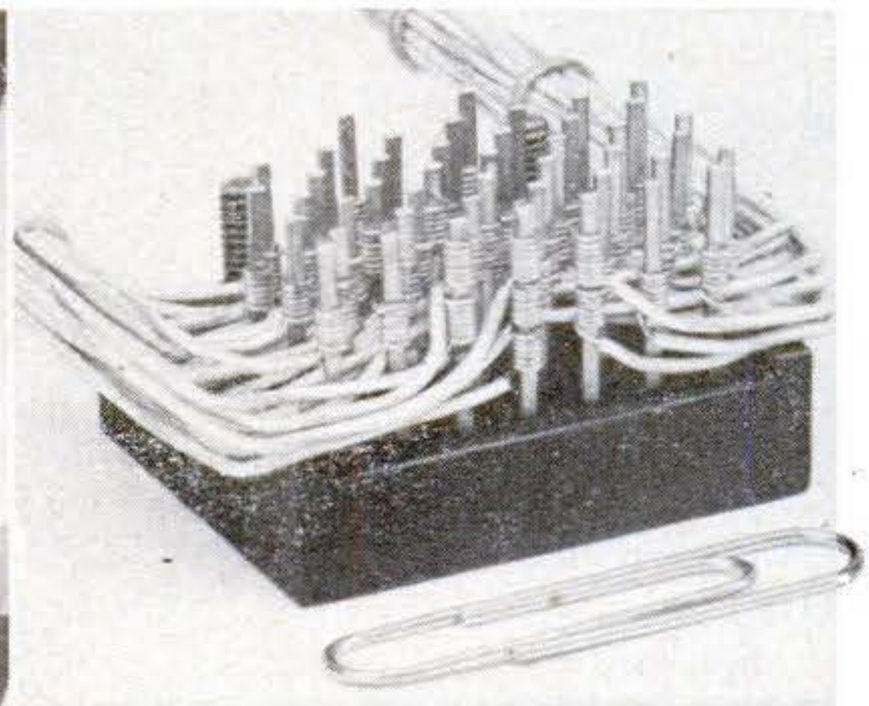
Wires Joined Without Solder

TELEPHONE men hook wires to terminals *one billion* times in a single year. Until now most of these connections have been soldered, a process requiring costly, scarce tin as well as some skill and time. Now a new power tool that looks like a handy man's electric drill can make the connections without solder by wrapping the wire tightly around the terminal. Fast and easy to use, the wrapping tool fits into tiny places where a soldering iron would be very difficult to use.

The Bell System is already making the tool for its own use. Now under development: an improved version that will cut, skin and wrap the wire all in one operation.



TERMINALS must have sharp edges to make nicks (visible in untwisted wire above) that give contact area needed for good electrical connections. Rectangular, U- or V-shaped terminals are best.



PAPER-CLIP-SIZE TERMINAL BLOCK may require 132 connections—a nightmare even for an artist with a soldering iron. New tool does this job easily.

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NOW
a power tool that's

Really New!

SHOPMASTER'S

Sensational 20" JIG SAW

with Self-Contained Motor

Think of it—this rugged 20-inch jig saw has its own built-in motor! Not a solenoid or a vibrator, but a full-rotating armature, powerful AC motor.

A rugged, professional power tool that cuts up to 2½" stock with ease, this newest of all power tools makes precision woodworking actually easy. Shopmaster's EXCLUSIVE COMBINATION MITRE GAUGE AND RIP FENCE accessory sees to that!

Want to rip? Just turn saw head 90°. It's that simple. Truly the most outstanding QUALITY power tool value on the market today!

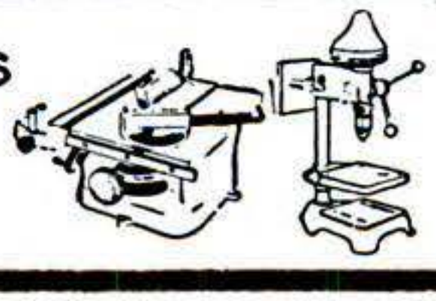
Just plug it in

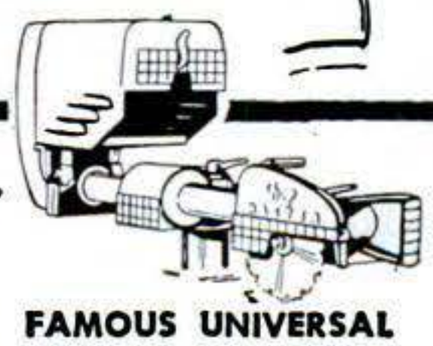
(Exclusive combination mitre gauge and rip fence available at slight extra cost.)

$39.95 *Motor included*

Slightly higher in zone 2

OTHER FAMOUS **SHOPMASTER TOOLS**





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There's a Shopmaster power tool for every need. Write today for catalog of complete line.

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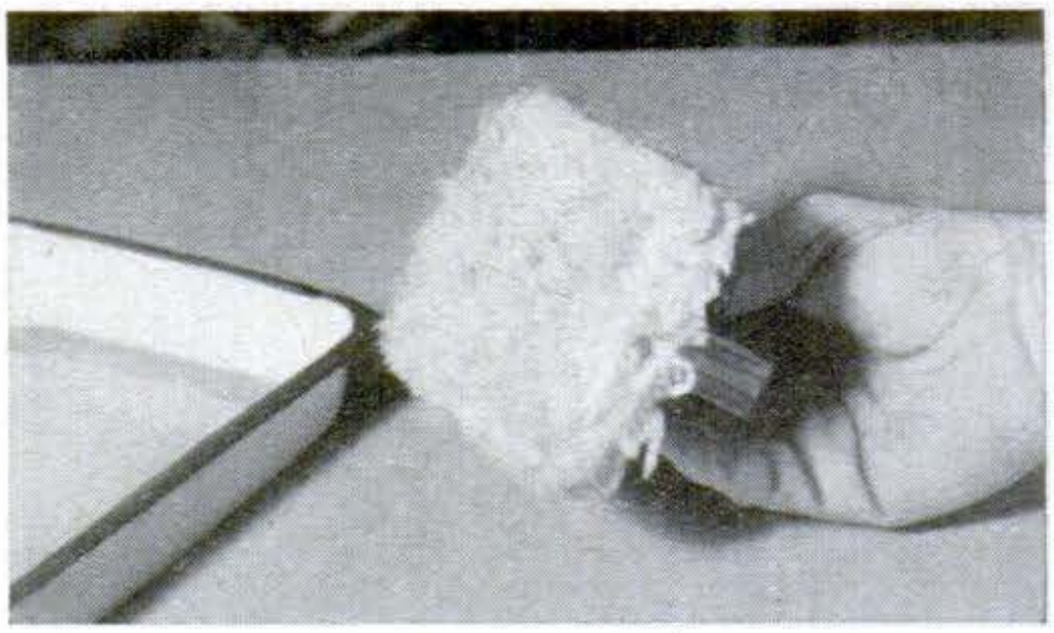
How to Cut Out a Wall Stud

THIS trick avoids chopping holes in *both* sides of a wall to cut out part of a stud for a new bathroom cabinet. From the side that must be opened, cut through the stud at the desired points. Then slip a hacksaw blade behind the cut section and slide it back and forth to saw through the lath nails.—*Harold J. Jones, Council Bluffs, Iowa.*



Swab Gives Smooth Varnish Coat

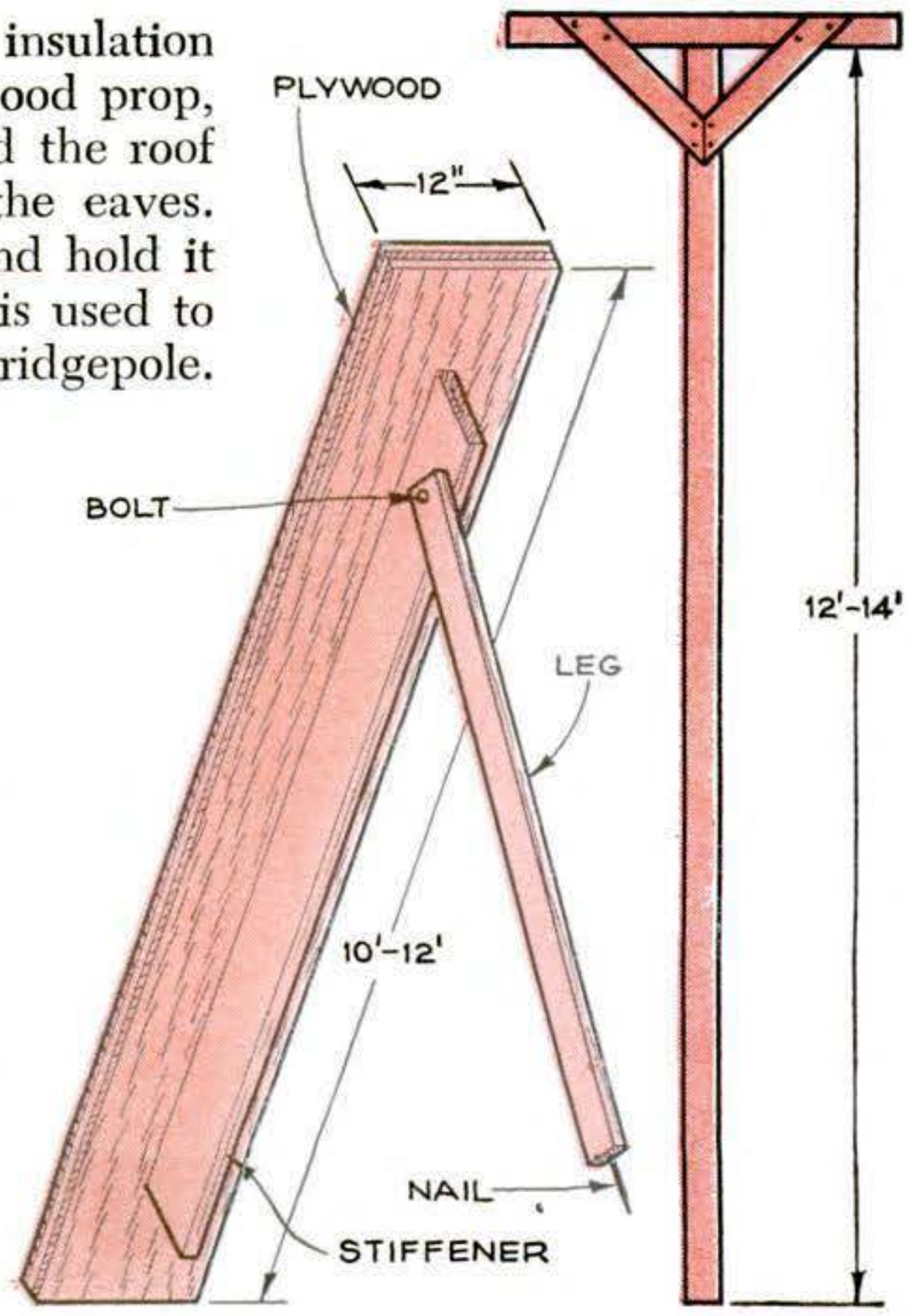
YOU will get a thin, satin-smooth varnish finish if you use a sheep's-wool swab instead of a brush. The swab is just a 4″-by-6″ wood block with the wool tacked on and another block screwed and glued on for a handle.—*Gordon F. Rietveld, Milwaukee.*

Labeling Magnetic-Tape Reels

UNLABELED reels of magnetic tape are like unlabeled food cans—you can't tell what you have without trying them. The reels can be pencil-marked after roughening with emery cloth.—*Andrew Vena, Philadelphia,*

Props Hold Insulation Blanket While You Staple

WITH these scrap-lumber supports, stapling insulation between attic rafters is a one-man job. The plywood prop, set up to give plenty of clearance between it and the roof boards, lets you chute the insulation down to the eaves. Then the leg is moved to push the blanket up and hold it for stapling. With that end in place, the T prop is used to wedge the upper end of the blanket against the ridgepole. —*E. F. Lindsley, North Prairie, Wis.*



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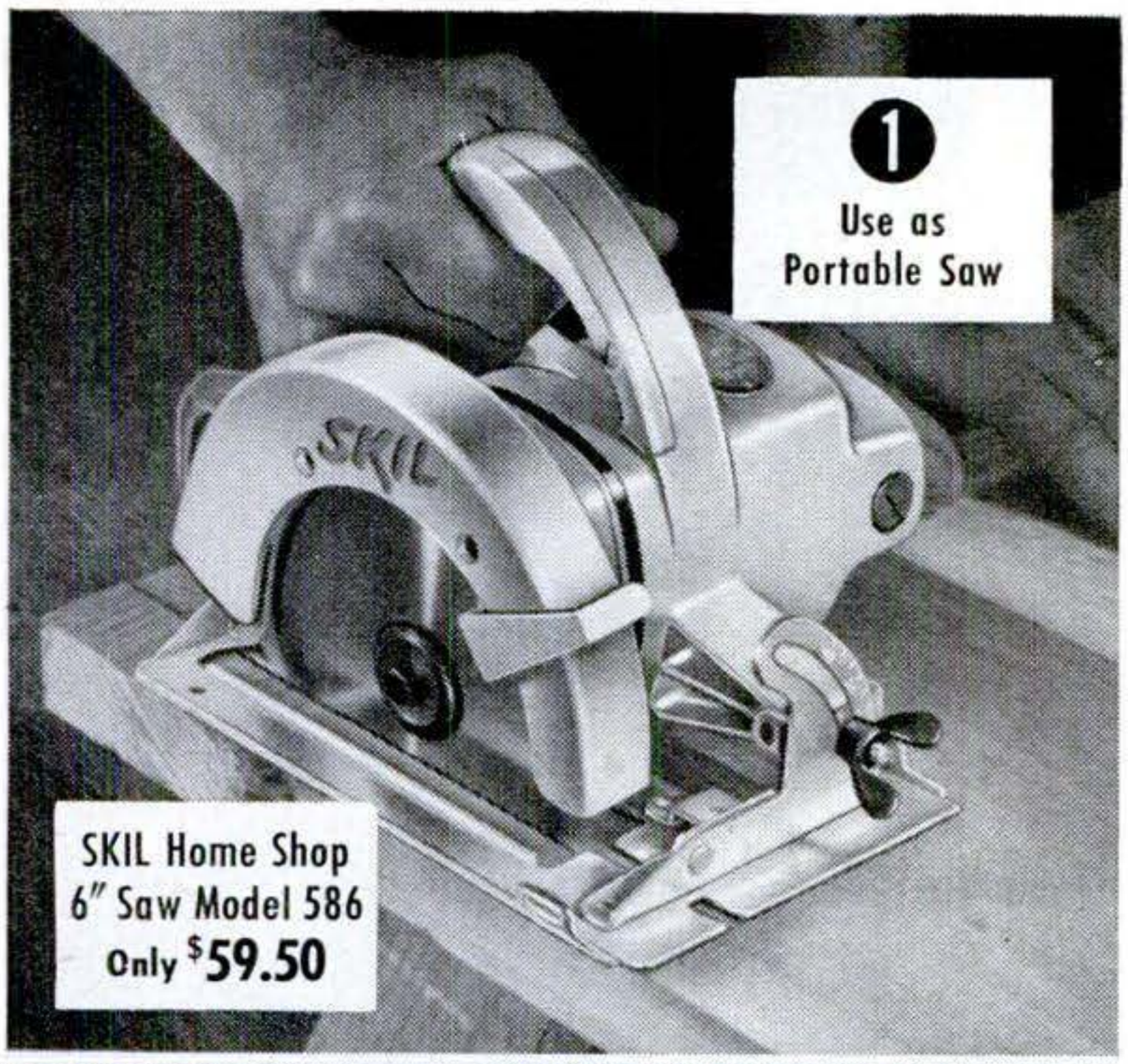
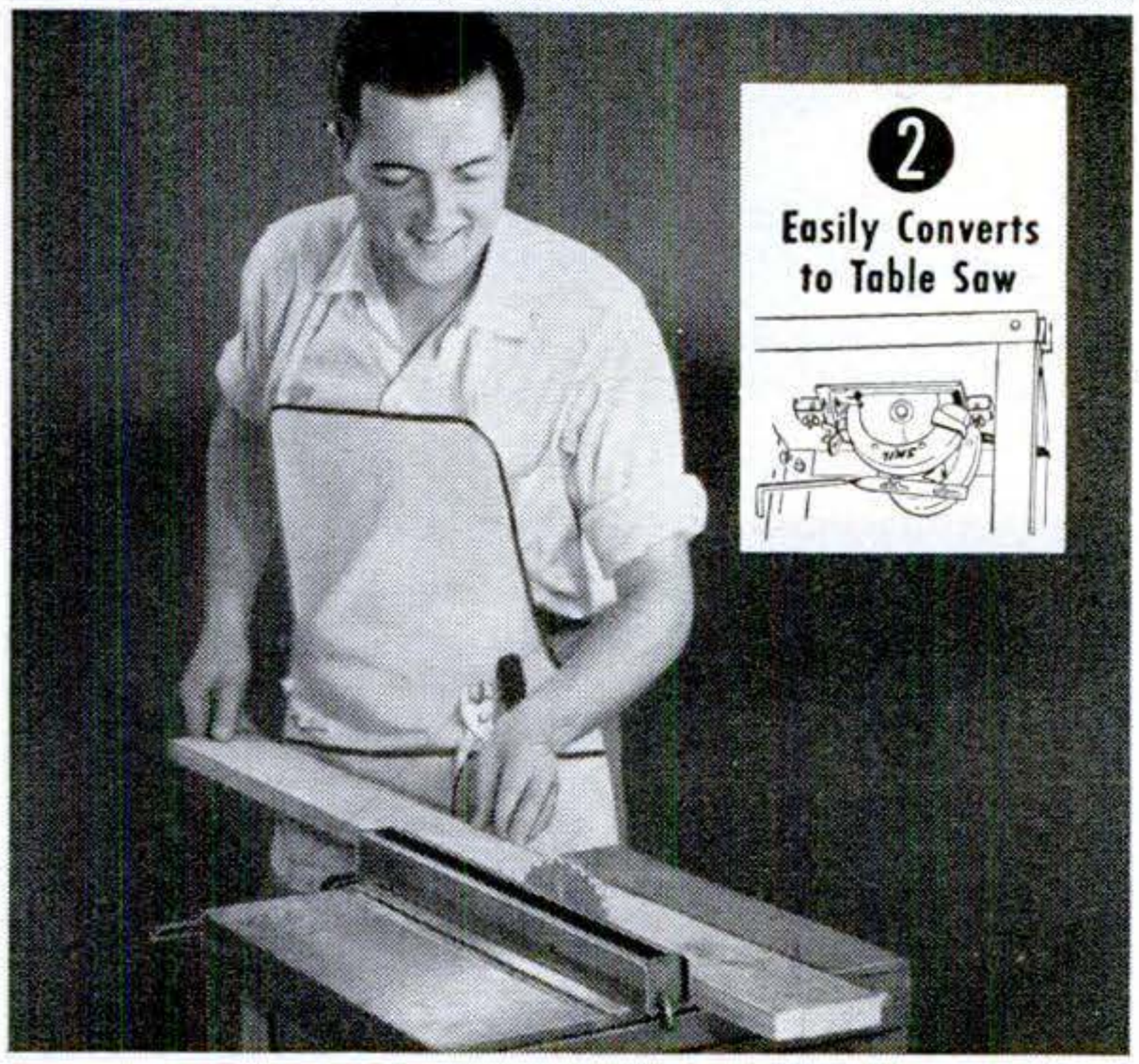
WITH PURCHASE OF ANY SKIL HOME SAW!





Once-in-a-lifetime chance to own a SKIL portable saw . . . plus a combination table saw, sander and shaper unit . . . at amazingly low cost!

Want the greatest value for your power tool dollars? Buy any SKIL Home Shop or Builders Saw and you get a Merchandise Certificate worth $20 on the SKIL Saw Table and Sander-Shaper kit—an unbeatable combination.

You have a *portable saw*—the preferred tool for building an extra room or garage. You're equipped to fit doors and storm windows, cut plywood panels, sheeting, siding—even stone, metals or compositions with special blades.

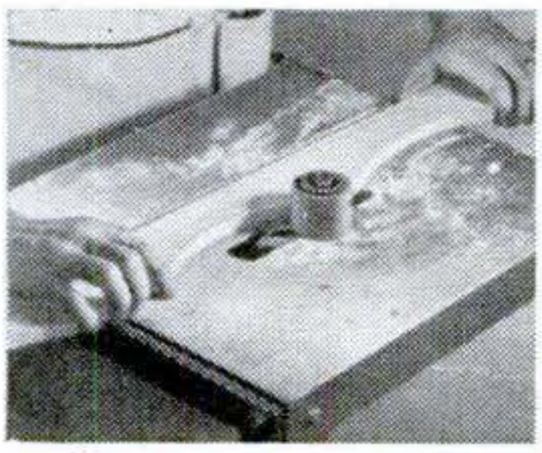
You have a *bench saw combination* for the precision sawing, shaping and sanding required in building cabinets, furniture and other such home projects.

Here—in this SKIL combination that costs *less* than a one purpose tool—is proof to you that it is not necessary to put big outlays into motors, belts, pulleys, to have a *complete* saw shop. See your SKIL Home Shop Dealer and save $20 on this wonderful SKIL portable saw, bench saw, sander and shaper combination!

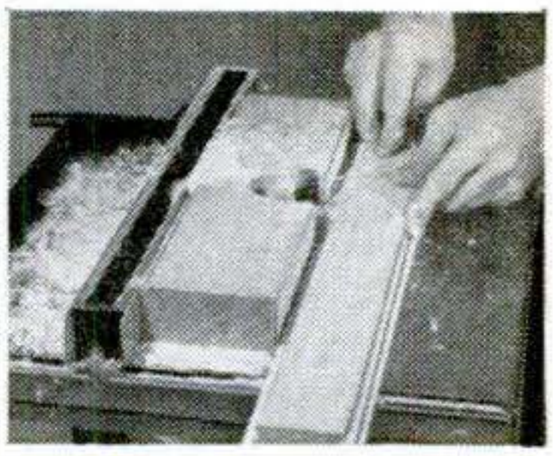
SKIL Saw Table Quickly converts your SKIL Saw to tilting arbor table saw. Makes all cuts —bevels, miters, cross cuts, rips. Actually doubles use of saw.

SKIL Sander and Shaper Kit. Quickly converts SKIL Home Shop Saw Table into shaper and drum sander for all drum sanding, grooving, moulding, shaping.

$20 Gift Certificate applies on this *complete* SKIL Sawing, Shaping, Sanding Combination.



3 Converts to Drum Sander



4 Use as a Shaper

SKIL Home Shop and Builders Saws—World's Finest For Remodeling, Home Construction, Home Workshops

Why be satisfied with ordinary saws when SKIL gives you so much, much more? You get greatest accuracy, maximum ease of handling with SKIL balance. You make fast, easy cuts with SKIL plus power. You make quick, simple bevel or depth adjustments and you're ready for any and every cut needed!

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Oversize Motor • Ball and Anti-friction Bearings • Built-in Bevel and Depth Adjustment • Telescopic Safety Guard Sturdy Die Cast Aluminum Housing • Trigger-type Switch

There are six SKIL Home Shop and Builders Saw models. 6"—7¼"—8¼" blade sizes. Priced from $43.95.

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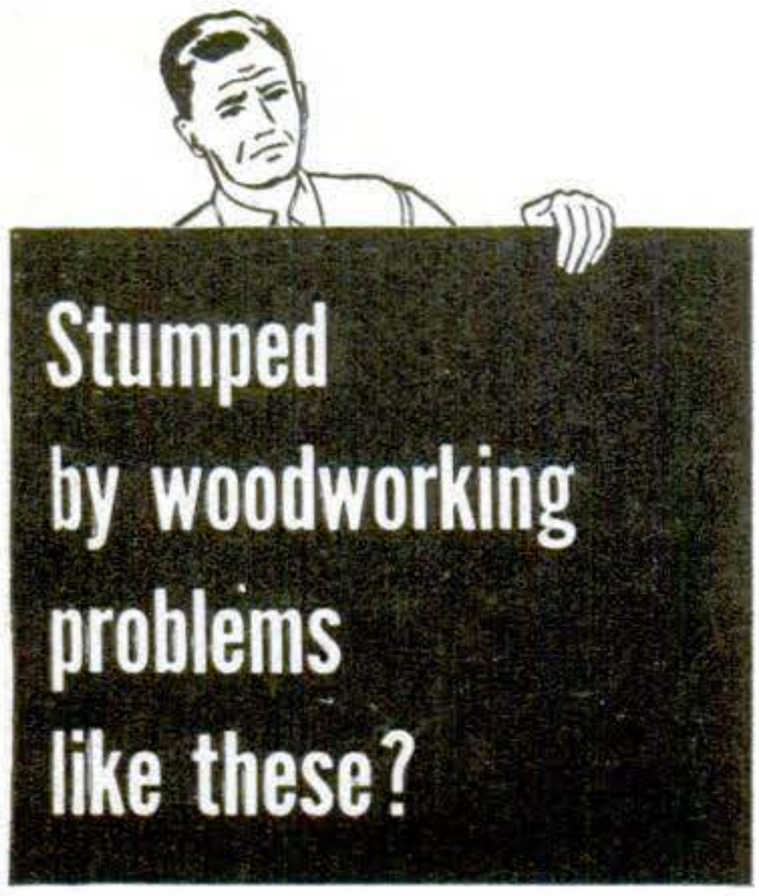
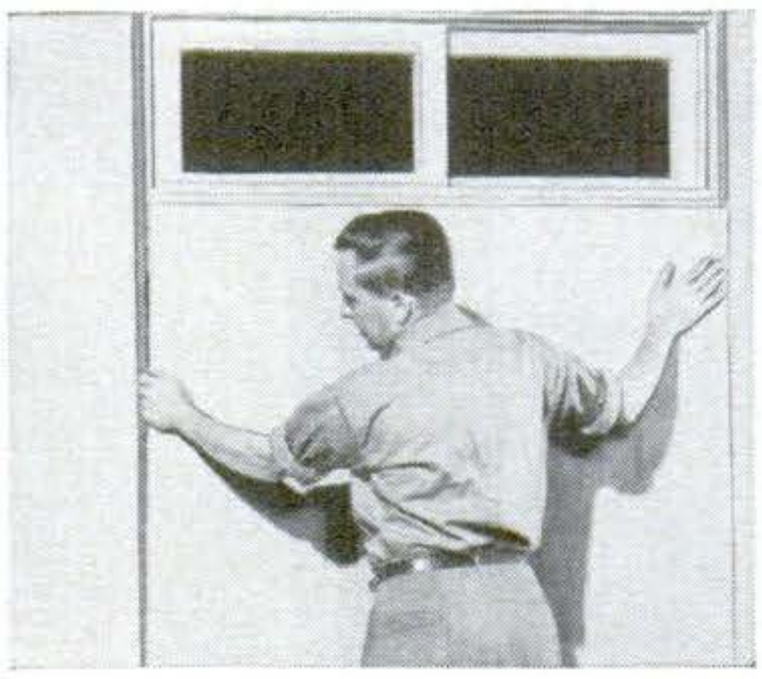
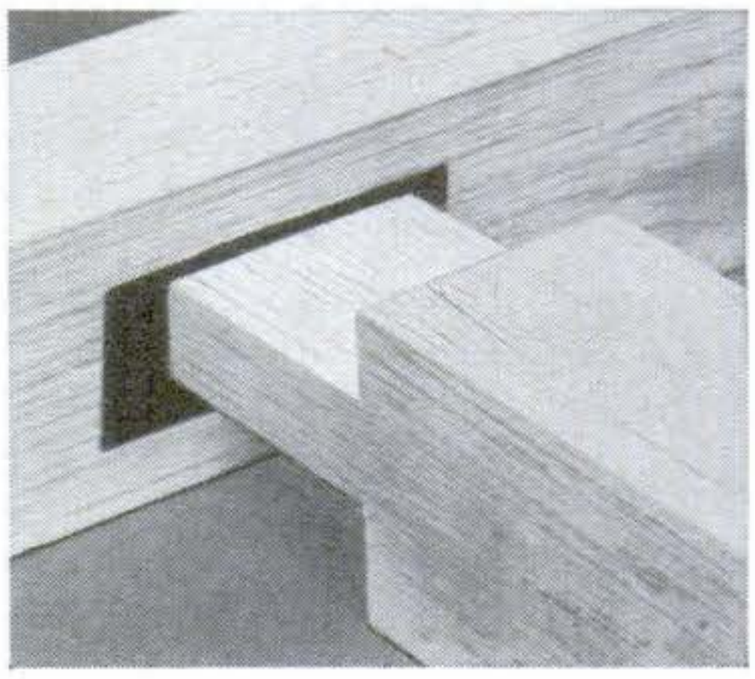
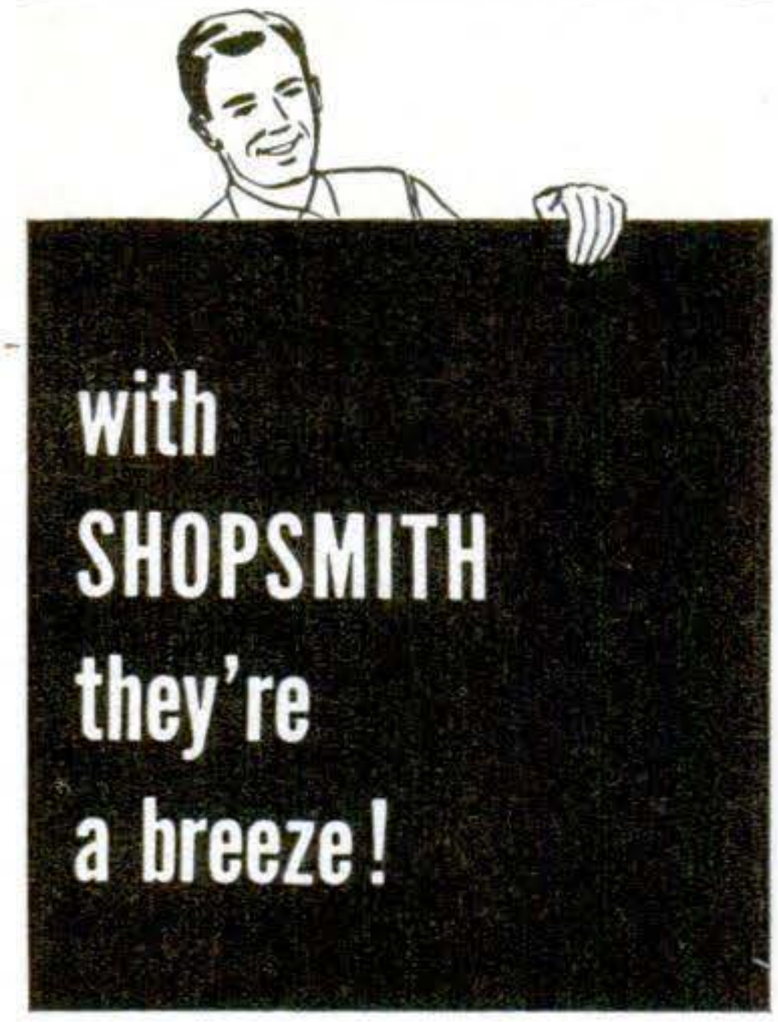


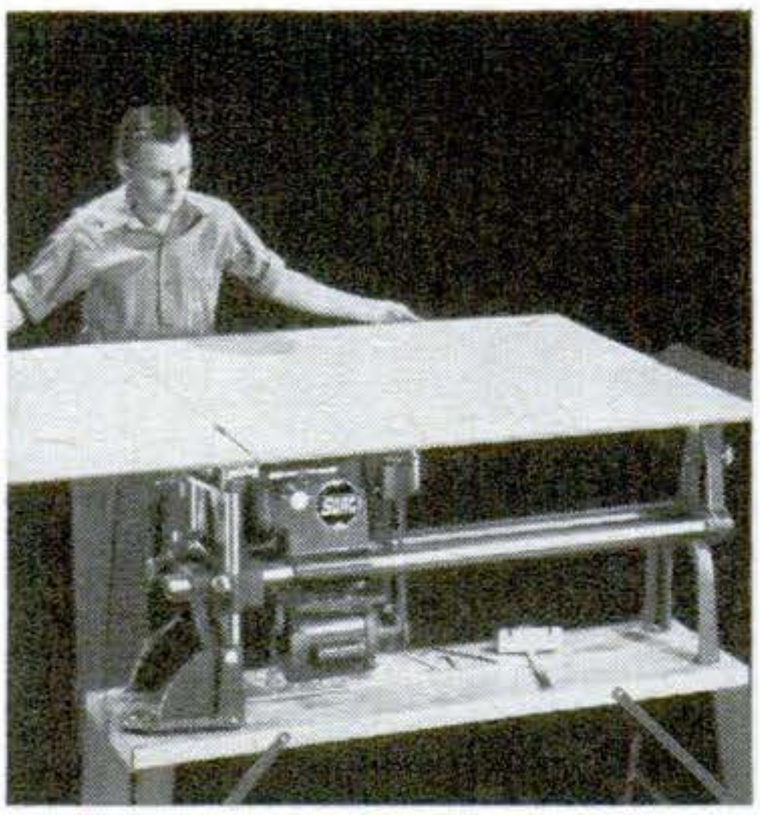
Ripped big panels that aren't square

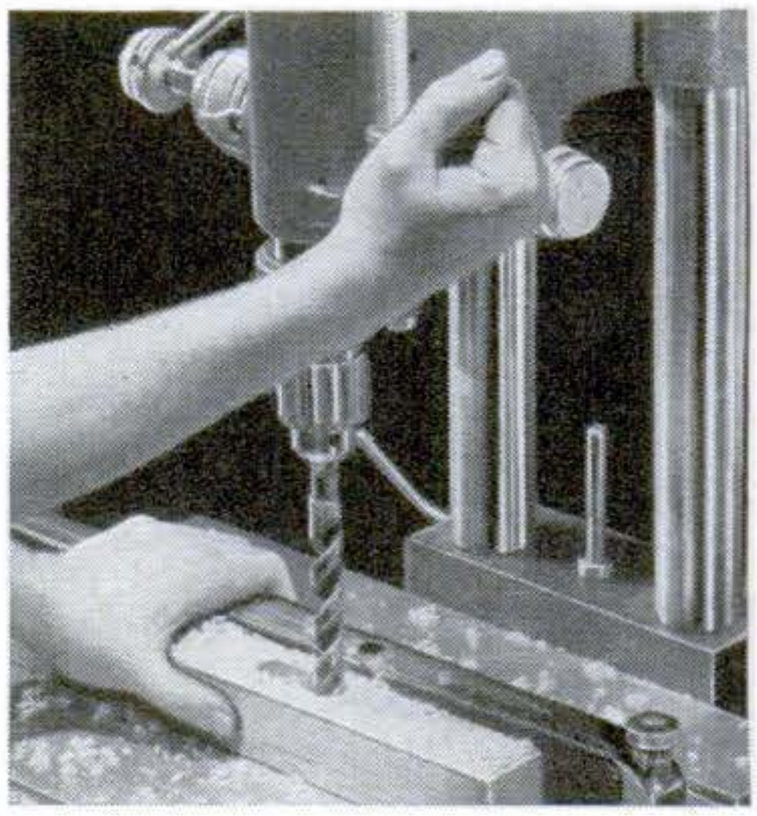


Mortises that are oversize









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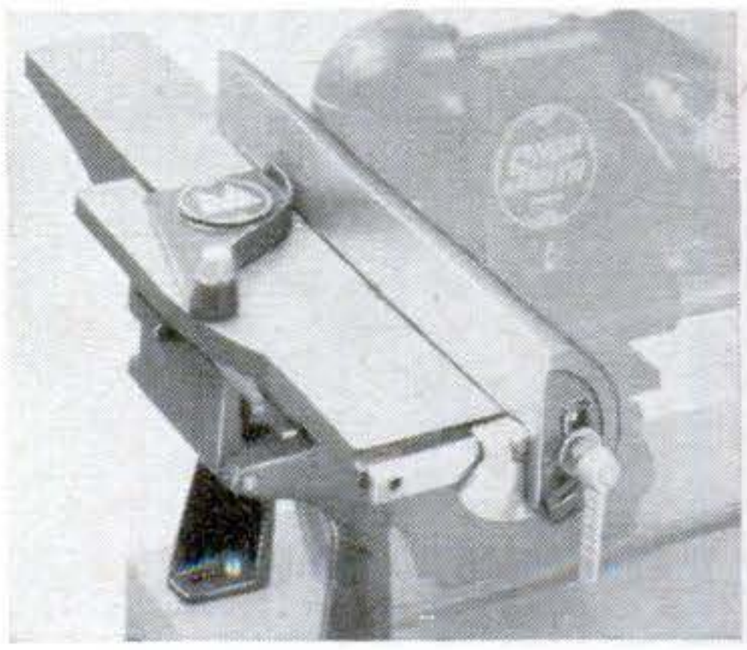
ONLY A BIG SAW CAN RIP BIG PIECES with accuracy. SHOPSMITH's 8" Circular Saw has an effective table size of 54" x 17". With it you can rip an 8' panel through its *exact* center into two 4' sections. By using the fence, you're assured of a square, clean cut. Maximum depth of cut of 2¼" comes in handy when you're doing heavy work. Large miter gauge has automatic spring stops from 0° to 60°.

New SHOPSMITH 4" Precision Jointer!

Extra-long 28" table. Attaches quickly, easily; yet it doesn't interfere with SHOPSMITH flexibility. Can be operated simultaneously with saw as conventional saw-jointer combination. Three-knife cutter head runs on grease-sealed ball bearings. Unique Allen-wrench adjustment is easiest method ever devised for jointer knife adjustment. Fence tilts 45°-45°; automatic stops. Width of cut, 4"; depth of rabbet, 5/16". Only **$44.95** (mounting kit, **$9.95**).

OVERSIZE MORTISES ARE NO REAL PROBLEM when you can drill truly "in-line" holes. With SHOPSMITH it's easy to line up holes because fence and table, working as jigs, assure accurate parallel drilling. You can even convert SHOPSMITH into a floor drill press, to mortise large doors for locks. Spindle is supported by *four* grease-sealed ball bearings, is stress-proofed with induction-hardened tip.



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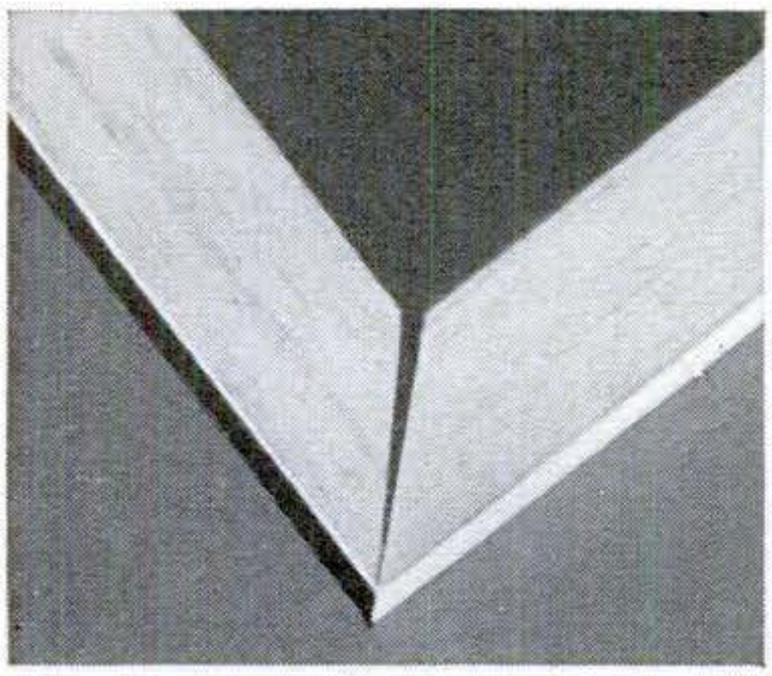
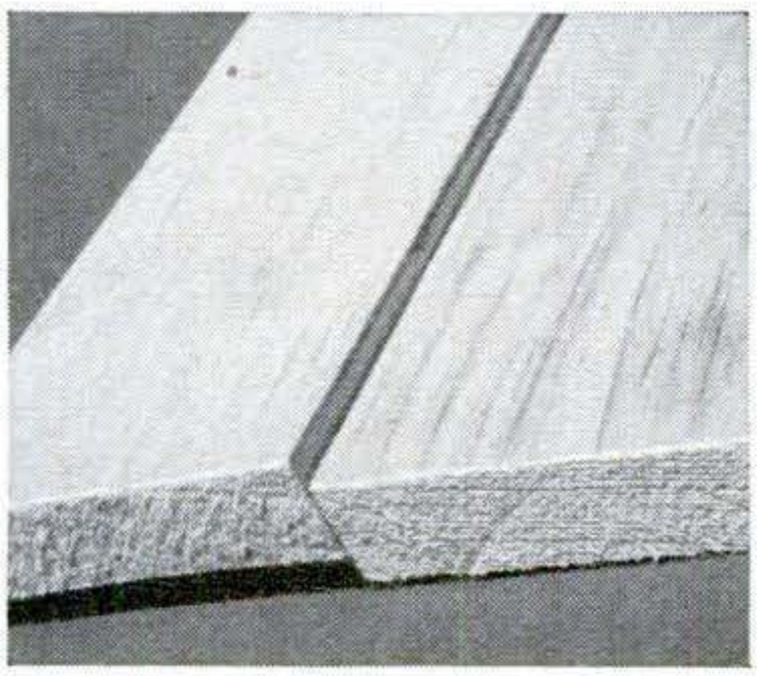
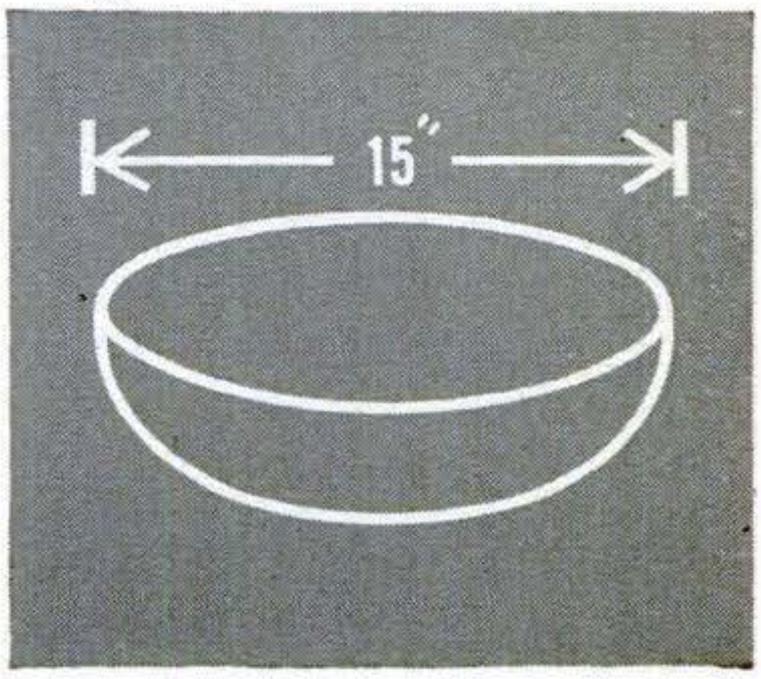
Mitered joints that don't quite fit

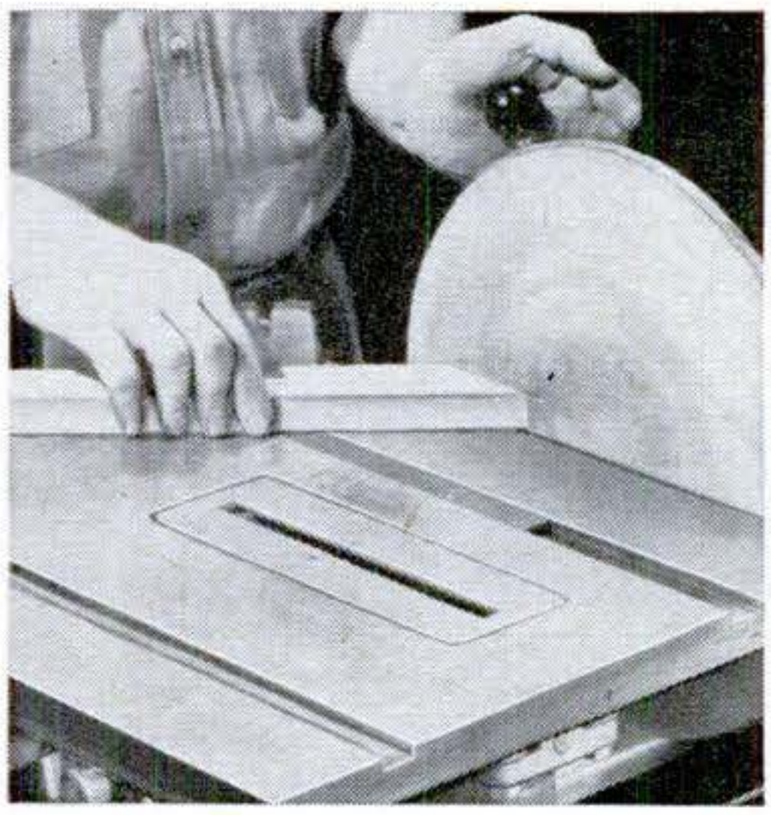


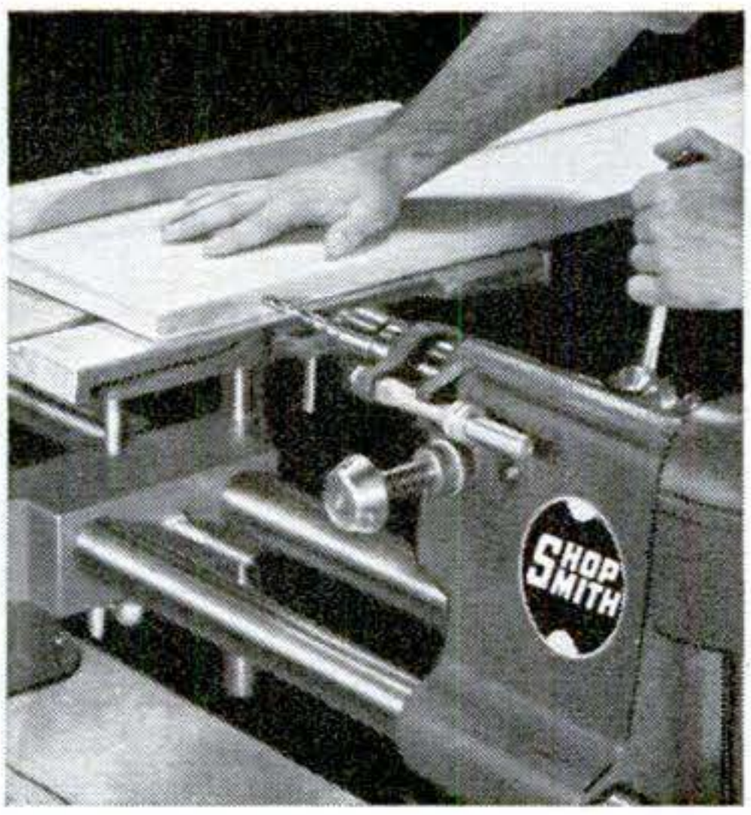
Doweled pieces that won't line up

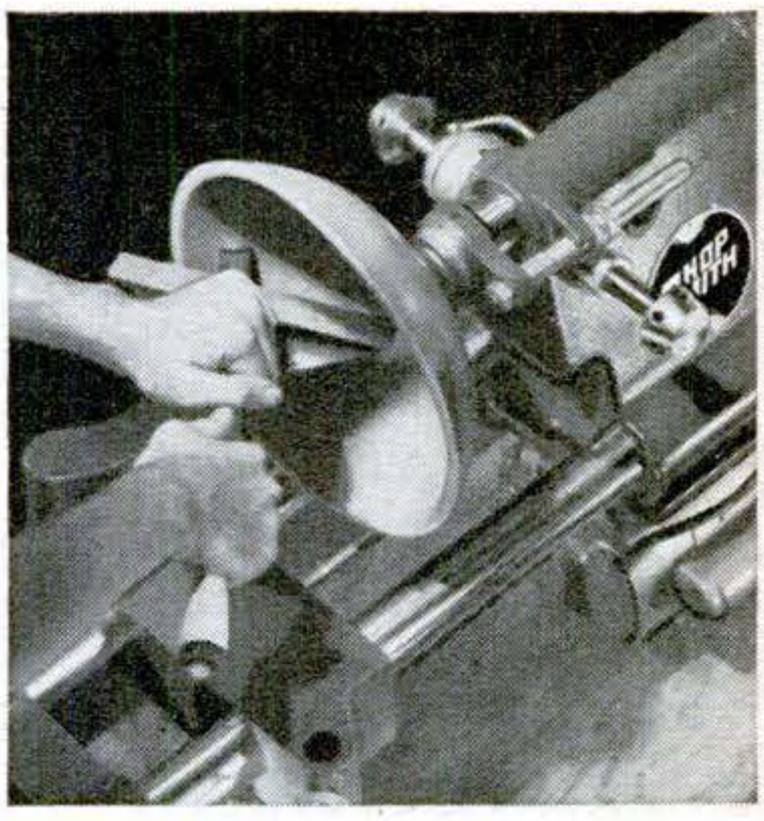


Bowls that are too big to be turned









TO MAKE REALLY ACCURATE MITERED JOINTS you have to take into account "creeping" of the wood and saw blade deflection. By finish-sanding mitered pieces with the SHOPSMITH Disc Sander, you easily eliminate these errors. No mitered joint is as accurate as a finish-sanded joint—and SHOPSMITH *alone* has a Sanding Disc that can be fed *into* the work. Make duplicate parts quickly and accurately.

FOR PERFECTLY DOWELED JOINTS, the SHOPSMITH Horizontal Drill Press is the perfect answer! Rigid fence support and adjustable table height make drilling for dowels easy as A, B, C—and absolutely accurate. No time-wasting setup of doweling jig necessary. Miter gauge serves as guide, particularly for precise right-angle drilling. Jacobs key chuck takes drills from 5/64" to 1/2" in diameter.

NOT MANY LATHES HAVE A 15" SWING, but SHOPSMITH does. With 4" more capacity than other lathes (except for a few expensive types), it's easy to turn beautiful, *big* bowls. You face the work on a SHOPSMITH Lathe; this greater convenience is your guarantee of greater accuracy. Centerless-ground tubular steel ways are heavy-walled and rigid. And, now they're chrome rust-proofed, too!

COMPLETE 5-TOOL UNIT

ONLY **$199.50**

Motor and bench extra*

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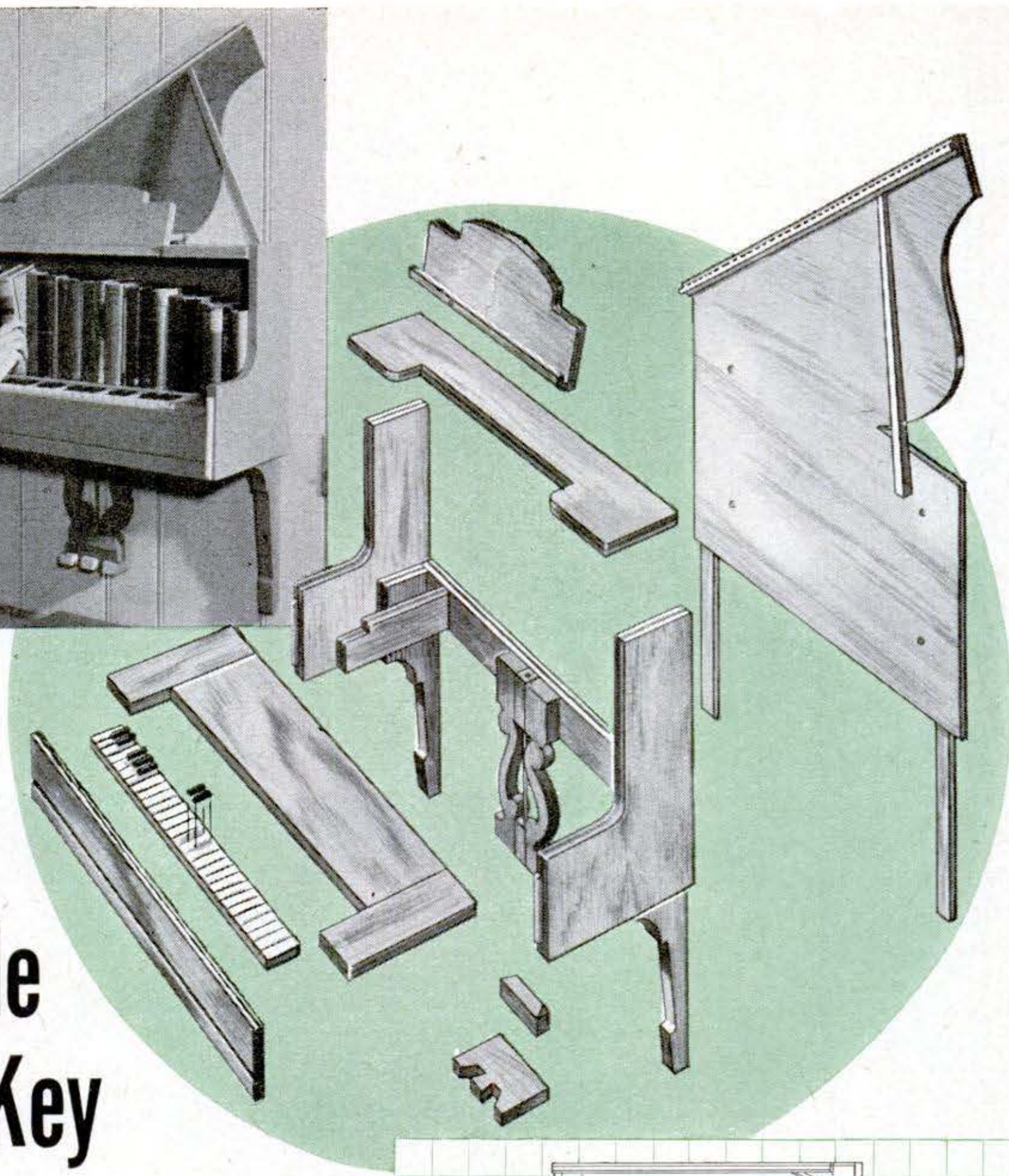
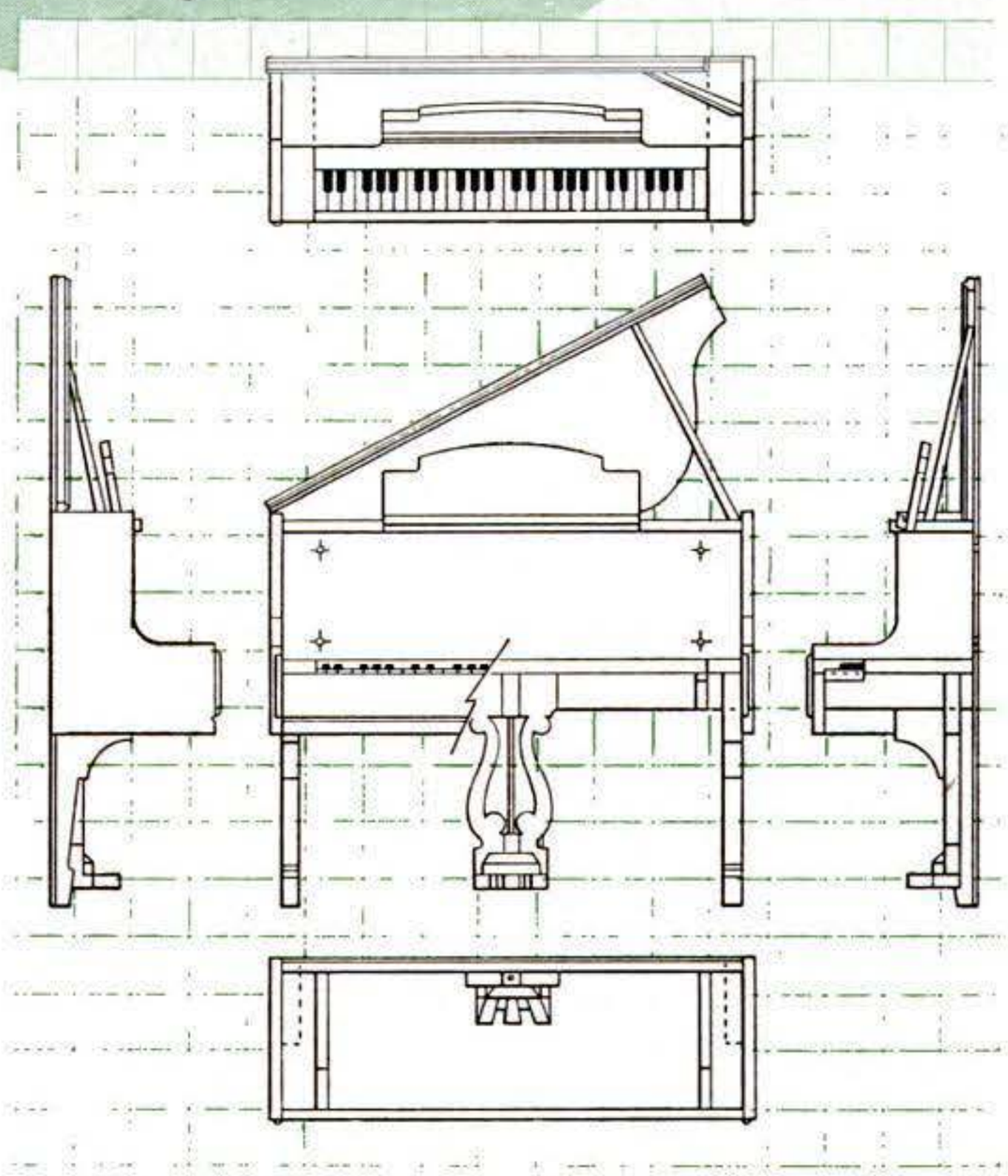


Off-Scale But On-Key Bookcase

IS THERE a teen-age musician in the house? If so, this baby-grand-piano bookcase will add an appropriate note to a study or bedroom wall. Most of the parts can be run off on a scroll- or bandsaw, using ¼″ and ¾″ plywood.

Exceptions are the piano legs and pedal assembly which are made of 1⅛″ dressed pine, trim formed from ¼″ and ½″ half-round stock, and a 1″-thick keyboard cut in one piece and slotted with a circular saw to give the effect of individual white keys. The black keys are bits of stripping cemented in place above the slots.

Use semi-gloss paint for the piano, accenting the book recess with a darker shade. Pedals and trim are gold, and the keys should be painted with high-gloss enamel.—*Henry B. Comstock.*



PIANO BOOKCASE was dimensioned to decorate corner in designer's home, could be made almost any size. Drawing above indicates proportions. Each square represents 2″.

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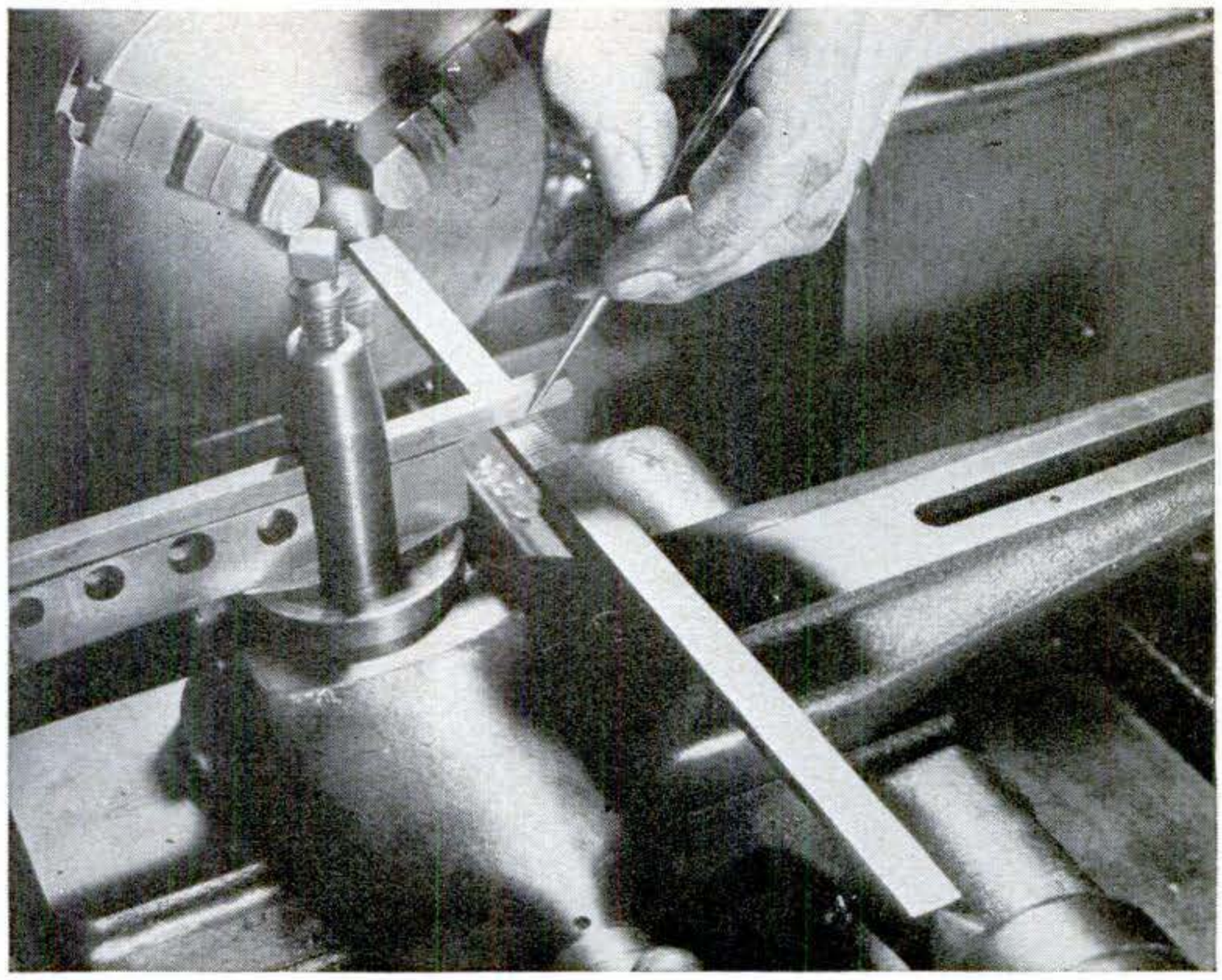
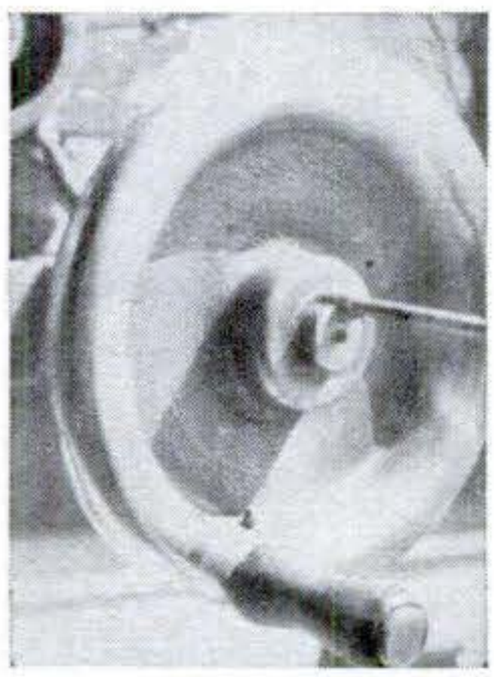
NEW Shop Ideas



Lathe Spaces Divisions. You can rule odd fractions of an inch such as tenths, thirteenths, or one-hundred-twentieths, and to almost any length, with the lead screw of your lathe. Mount the workpiece between centers and clamp a rest in the tool post, touching the scribing surface.

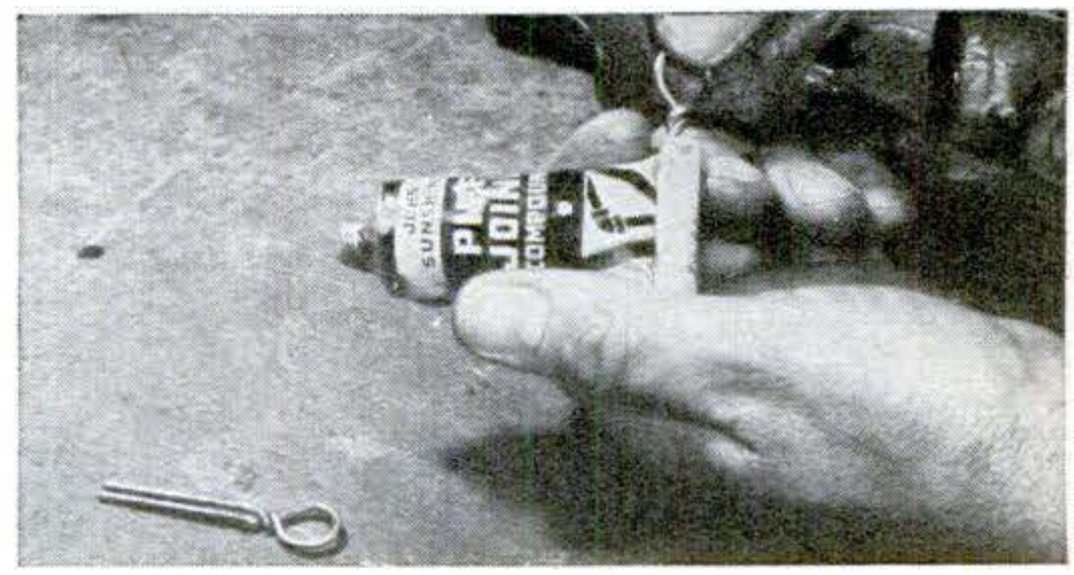
Set up the gear train to give the desired divisions and engage the carriage. Turn the spindle to align a mark on the faceplate or chuck with some reference point, and scribe the first line. Turn the spindle exactly one revolution, scribe the next, and so on.

To avoid gear-slack errors, never turn the spindle backwards. Always hold the scriber at the same angle. With a straight-shank center in the chuck as shown, you can gauge single turns by bringing the No. 1 jaw down on a wooden block placed on the lathe bed. *—Floyd McGuckin, Ridgewood, N.J.*

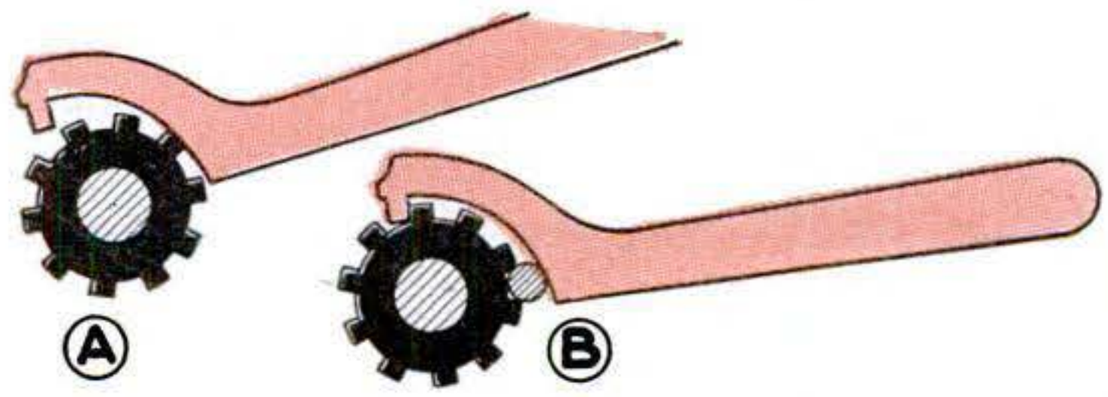


Setscrew Acts as Key. For a wheel or pulley mounted on the end of a shaft, a setscrew fitted as shown has advantages over the ordinary key and keyway. It not only locks the member against rotation, but also keeps it from slipping along the shaft, and can be installed without any milling.

Bring the hub flush with the shaft end and centerpunch on the line between them. Drill tapping size to full hub width if possible. Tap not quite all the way, which will let the setscrew jam tight. If necessary, the hub can be shifted endwise one or more threads.*—S. F. Pelton, Amarillo, Tex.*



Roll Tubes Empty. Middle-of-the-tube pinchers will think twice if you have a roll-up squeezer on it. One like this can be made in half a minute and will prevent tearing tubes and wasting the contents. Bend a 6″ length of coat-hanger or similar wire into a U with the ends almost touching. Clamp the legs in a vise, slip a bit of ½″ rod in the protruding loop and twist once. Remove from the vise and bend the legs parallel.



Using Oversize Spanner. When a spanner is too big for the nut, it will tend to rock out of the notch as at A. A small block or rod placed as at B will give it a good hold by keeping the business end in the notch. *—Federico Strasser, Santiago, Chile.*

Please turn the page for more shop ideas.

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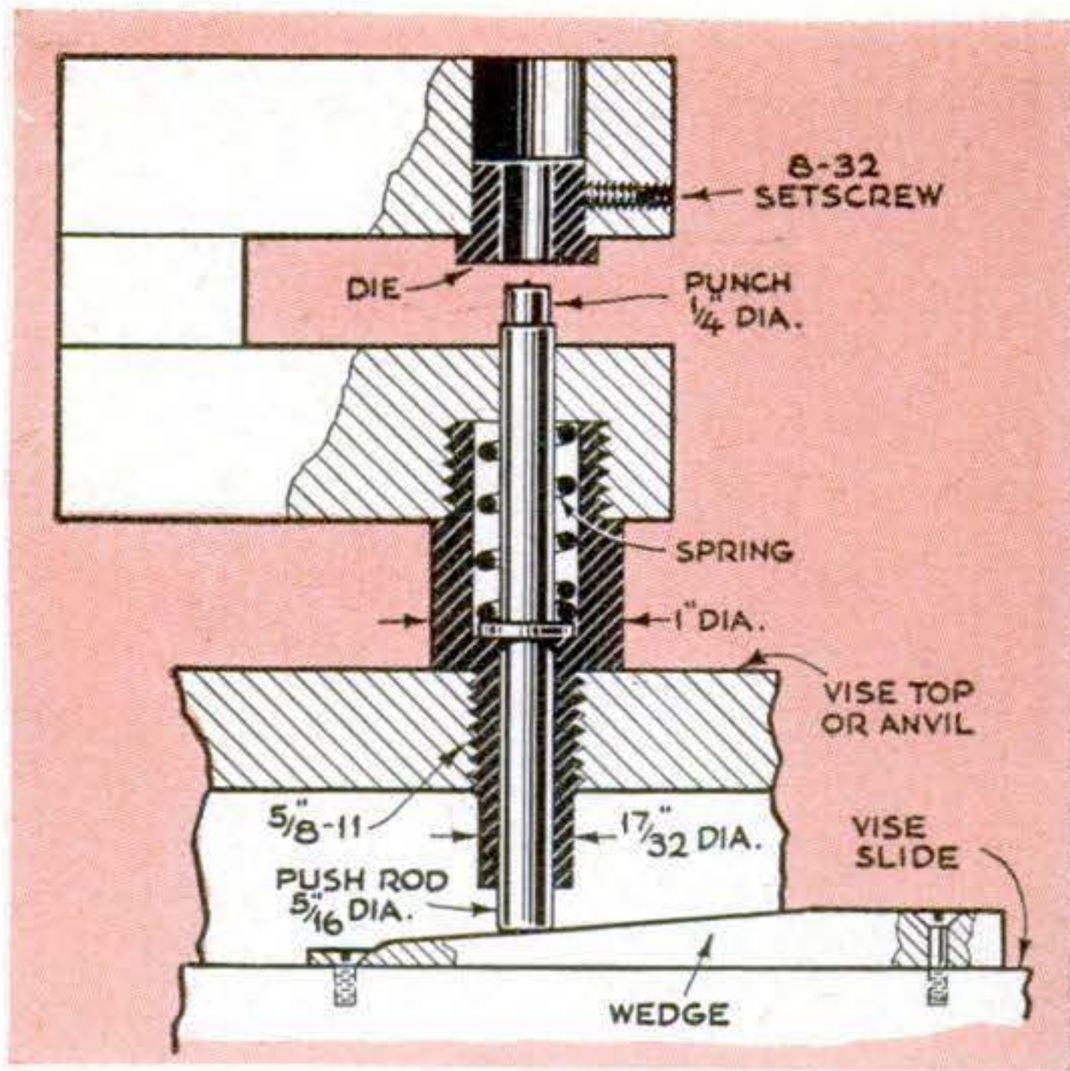
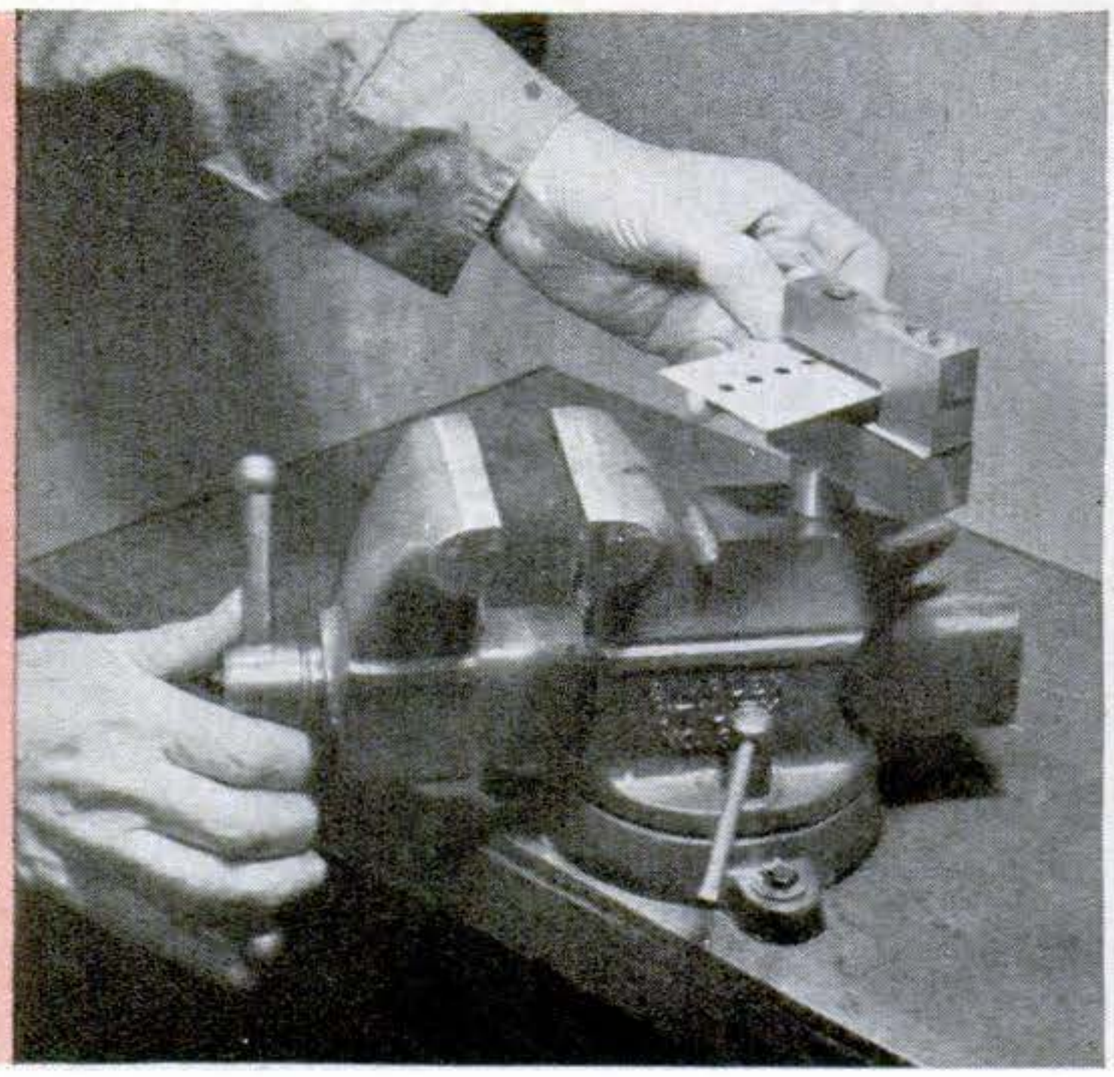




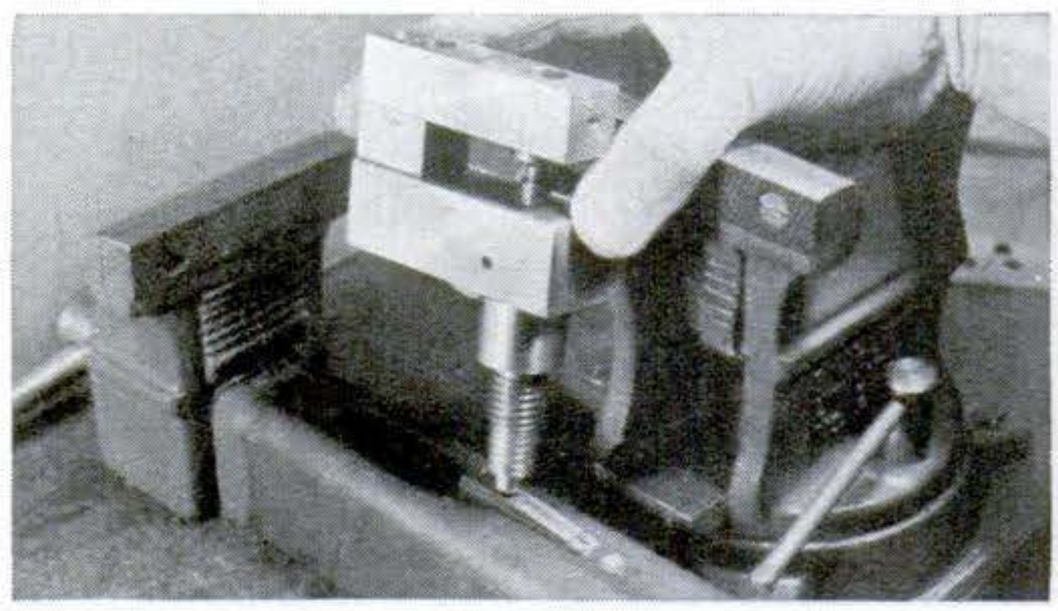
WITH VISE JAWS OPEN, punch is down for insertion of work. Turning vise screw to close jaws drives punch up with force enough to make ¼" holes in tin-can stock, sheet aluminum, fiber and thin plastic. With a triangular punch and a guide on the yoke, sheet metal can be notched.

Vise Punches Holes. The power of a vise screw can be harnessed for punching clean holes in sheet stock. A push rod, riding up on a wedge fastened to the vise slide, multiplies the force of the screw. With a thin, flat blade instead of a punch, shearing or slotting can be done.

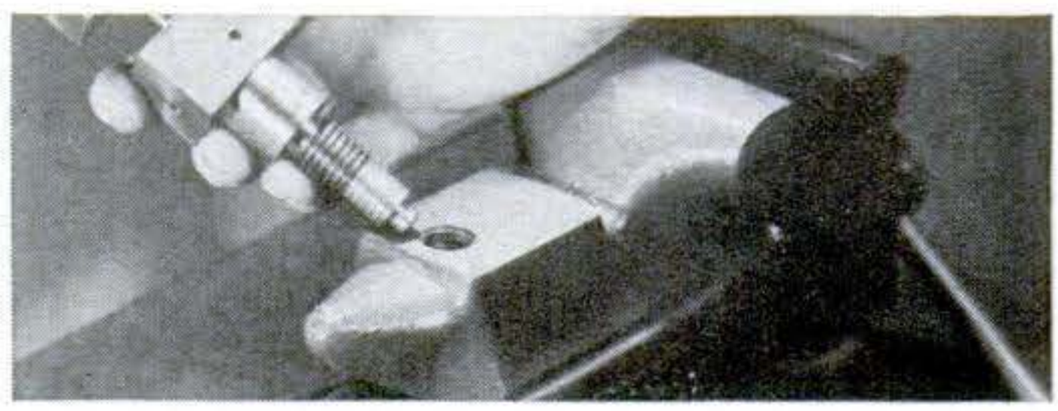
The yoke of the attachment can be made by bolting together three pieces of steel as in the photos, but a one-piece yoke cut from bar stock or built up by welding is better. The punch bore and die socket must be accurately in line for easy operation. One way to do this is to drill a ¼" hole straight across the yoke, and then open it out as required.

Machine the plunger body from bar stock. The coil spring, which bears on a flange turned on the end of the punch, must be strong enough to withdraw the punch from the work.

Make the wedge from hardenable steel, with a slope that will force the push rod up about ⅛" as the vise slide moves 2". Sink its mounting screws flush so that the push rod will not catch. A little of the vise casting may have to be cut away to clear the wedge when the jaws are wide apart. Locate the threaded hole in the anvil so that the push rod rests on the high end of the wedge when the jaws are closed.—*Walter E. Burton, Akron, Ohio.*

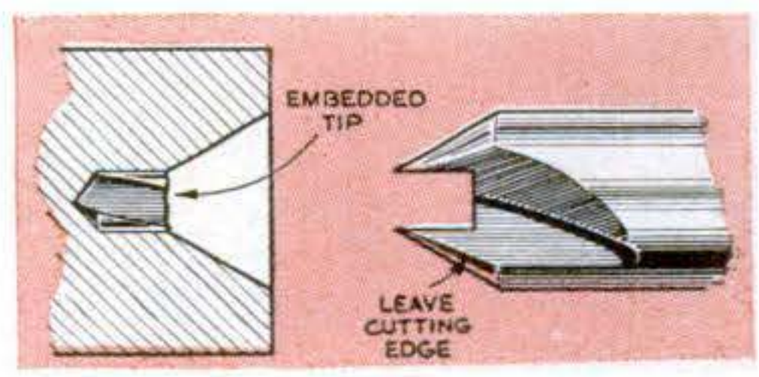


SCREW LEVERAGE is multiplied by the inclined-plane effect of a wedge on top of the vise slide. This is permanently attached and does not affect regular use of the vise.



PUNCH ATTACHMENT screws into a hole in the vise anvil and can be mounted or detached in a jiffy. To change punches, the yoke must be unscrewed from the plunger housing.

Drill Extracts Its Tip. When the tip of a centerdrill breaks off in the work, it usually defies removal. But the broken drill can be used to extract its tip. Grind a slot in the broken end as shown. Chuck as usual and drill around the embedded tip, which will fall out or catch in the slot. —*Thomas J. Kilb, Springfield, Mass.*



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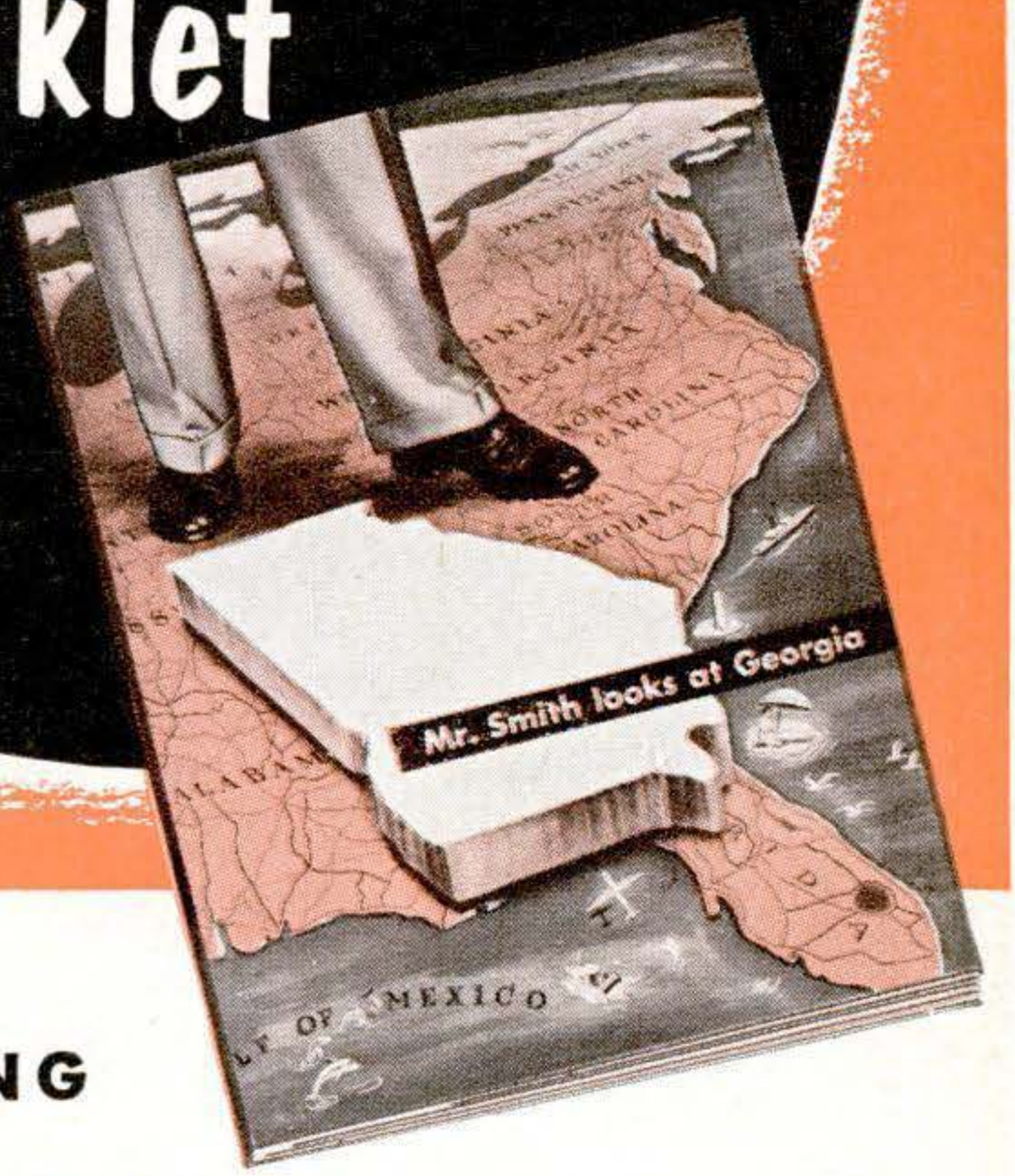

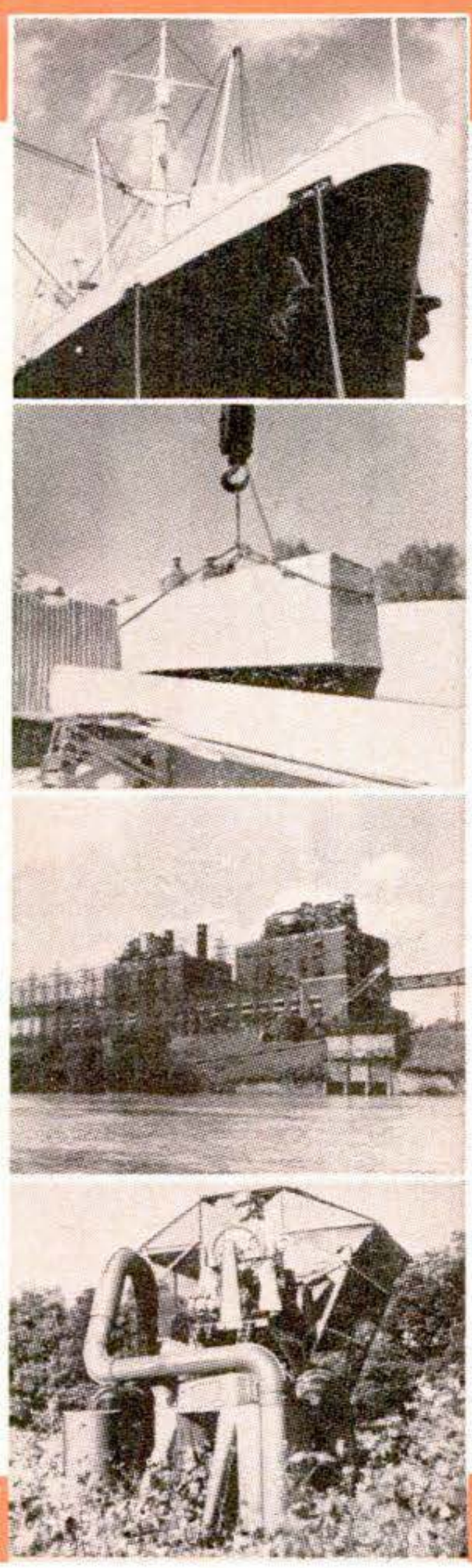

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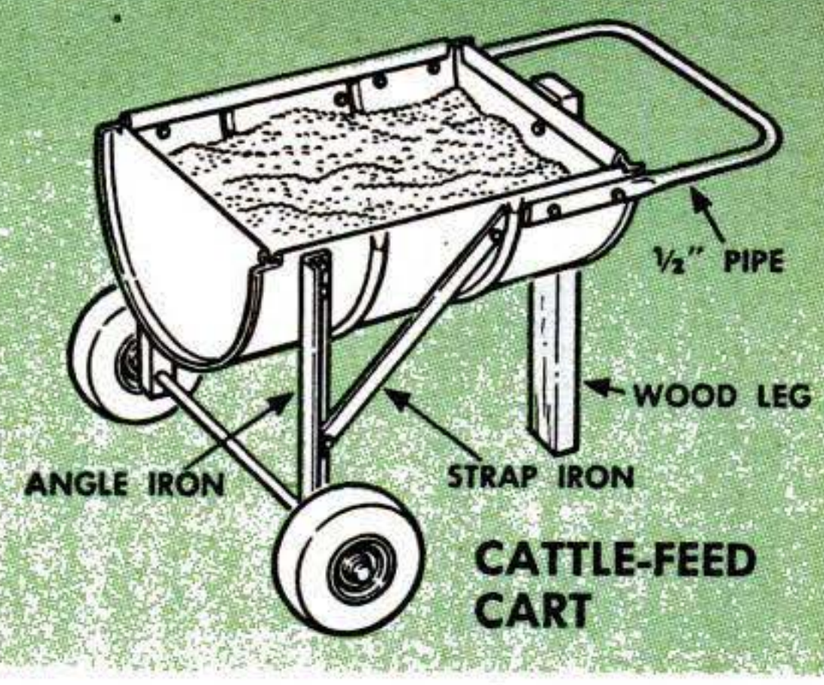
WHAT YOU CAN DO WITH

Steel Drums

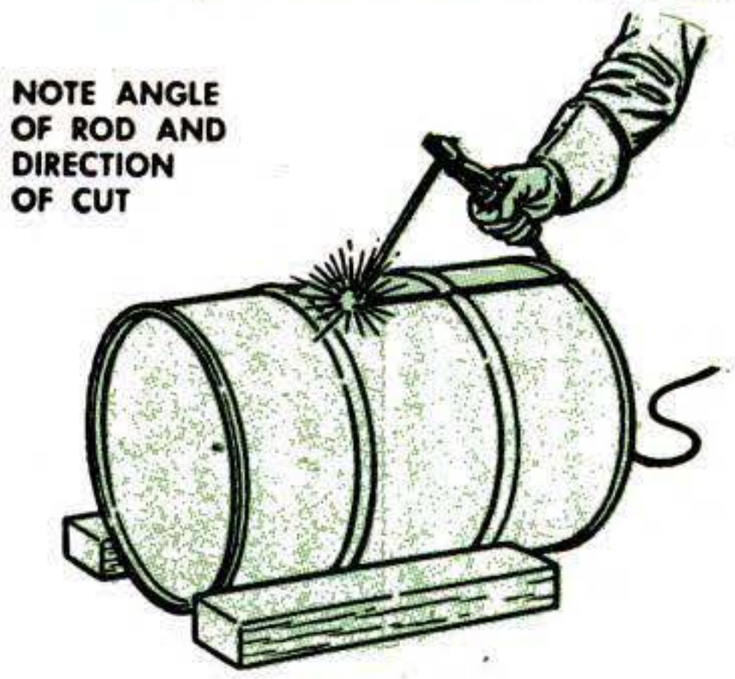
Cheap and easy to find, the big cans are raw material for many projects.



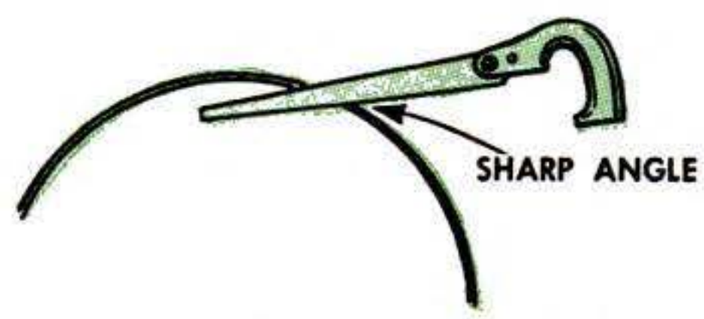
CATTLE-FEED CART

IF YOU think you need a lake to put a diving float in before you can make use of empty steel drums, take a look at these sketches. Junk-yard drums can become concrete forms, doghouse roofs, stoves.

Cleaning. Most drums once held oil or other inflammables, and a spark or flame can turn an uncleaned drum into an effective bomb. Use steam, or water and caustic followed by solvent to clean yours.

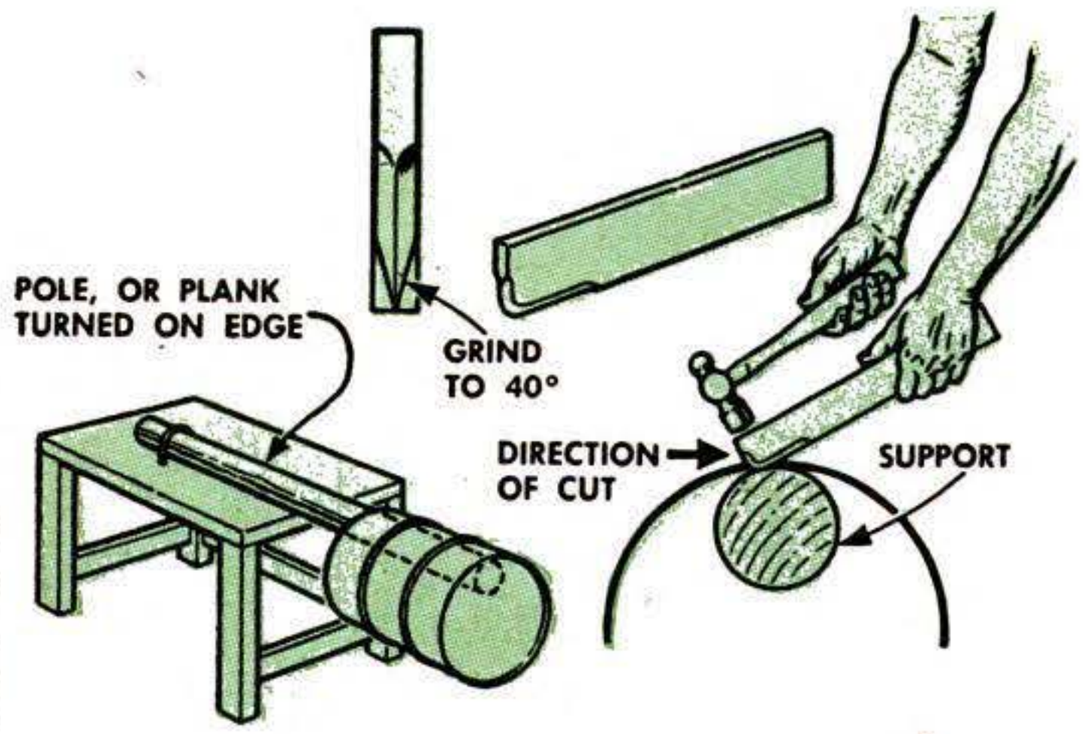


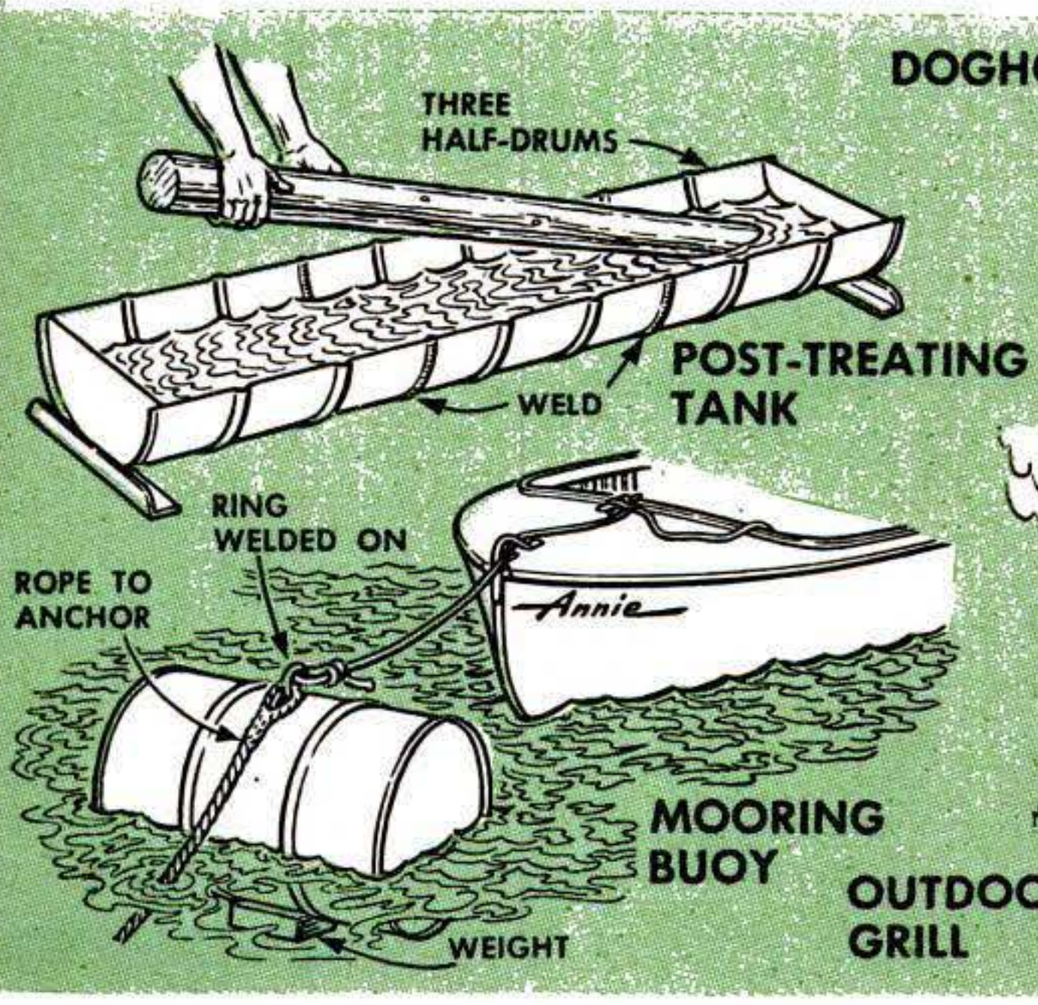
Cutting. An oxyacetylene torch does the fastest and smoothest job, but an arc welder is a close second. Set the welder for high rate of amperage—about 180—and



use a ¼" carbon rod or a 3/16" steel rod.

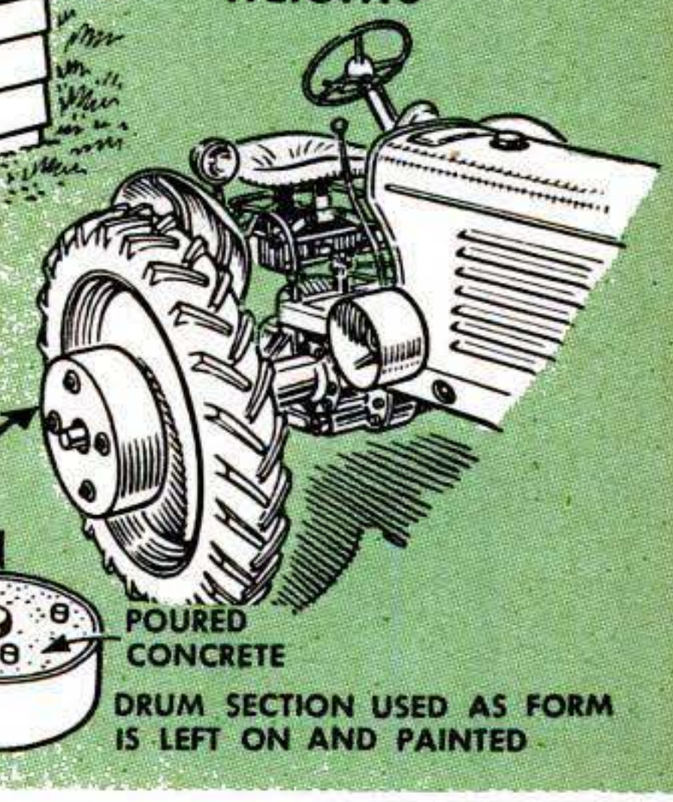
One of the new hacksaws that cut from one side only will cut a clean edge, but it is slow, hard work. Another effective hand cutter is a cold chisel, or better, a car-spring leaf ground as shown. This method

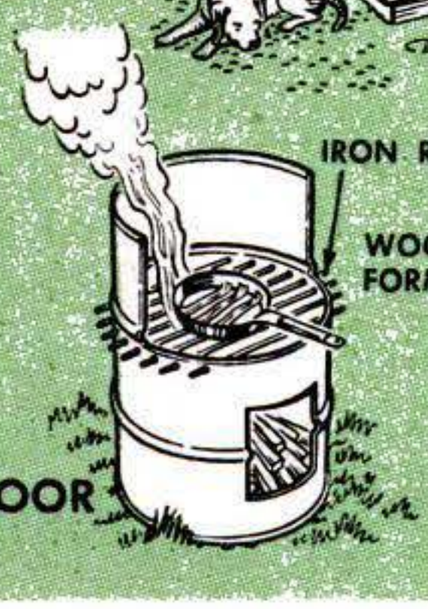




DOGHOUSE ROOF

TRACTOR-WHEEL WEIGHTS





OUTDOOR GRILL

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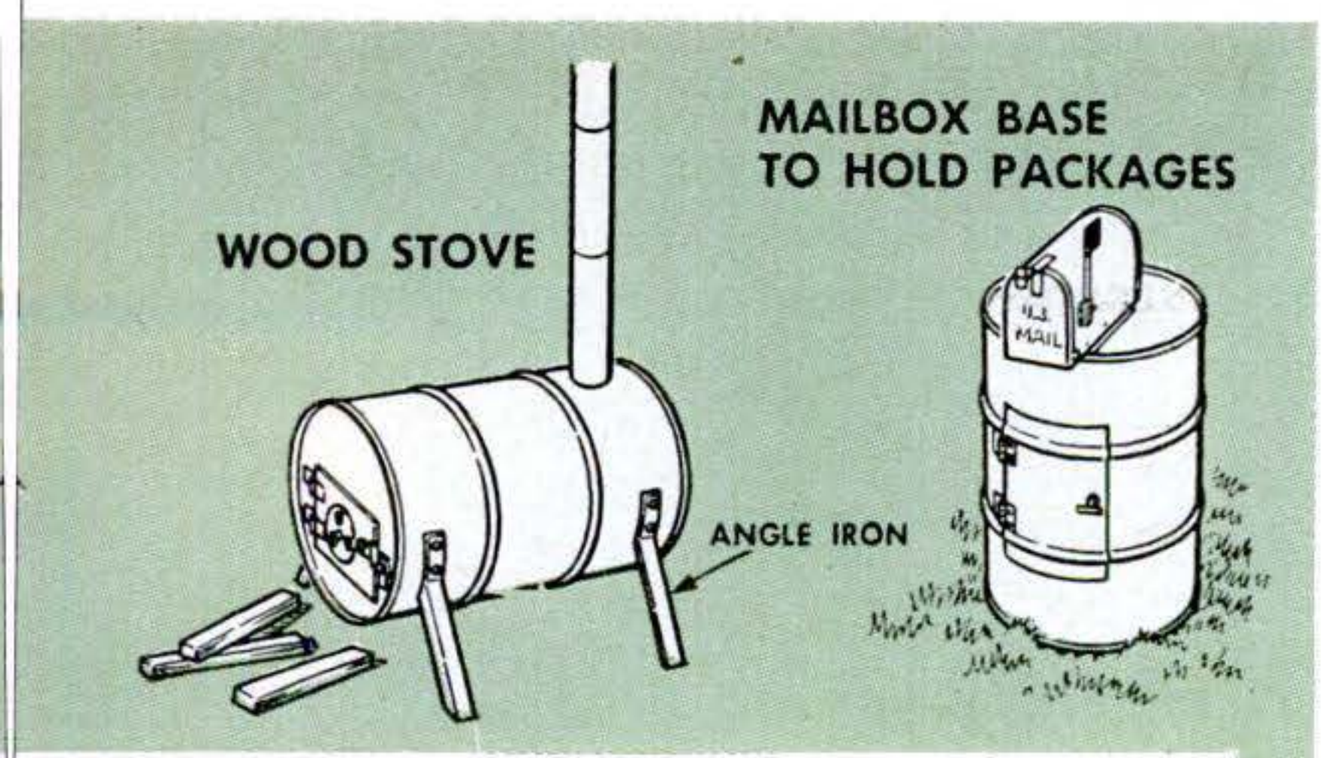
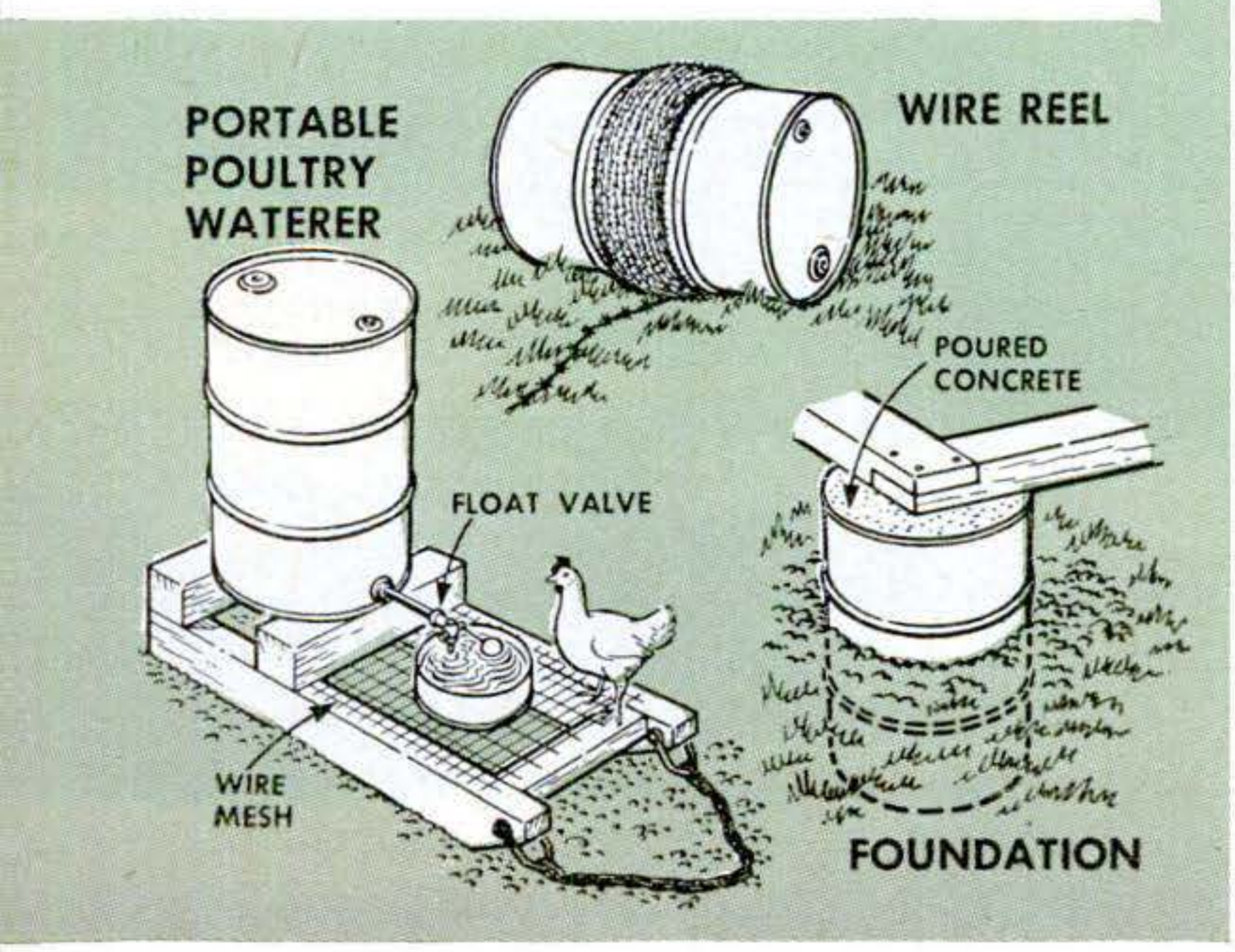


works best if the drum is supported under the cut by a pole fastened to a table.

Finishing. An adjustable wrench will make a neat folded edge—the jaw serves as a depth gauge. Bend a little bit at a time, and then hammer the fold tight on the

edge, not the bend. This leaves a strong, rounded fold.

Joining. To combine several sections into a long trough, brazing with an acetylene torch is best. Wire-brush the surfaces clean and use a 1/16″ or 3/32″ bronze rod and flux. If you are careful, you can also arc-weld joints, using ⅛″ or smaller rod and low heat of about 30 amp. Let the work cool frequently to avoid burning holes.—*Ralph S. Wilkes, Keuka Park, N. Y.*



They're Wearing Out '54 Cars Already

[Continued from page 155]

ance "stack-up"—a chance adding-up of small, acceptable variations.

You can't measure everything with a meter, which is one reason for evaluation trips. Six or eight engineers will travel several thousand miles, driving in ordinary tourist fashion. The cars are not instrumented, although radiophones are sometimes used to provide intercommunication.

Each man will take his turn driving each car, assessing points like handling, convenience, driver fatigue, wind noise, ventilation and reflection.

Test Tracks Are Research Labs

A lot of additional work goes on at most proving grounds. In conjunction with engineering labs there are continuous research programs on brakes, fuels, engines, lubes, vibration, suspensions and handling. Teams of engineers and mechanics also are assigned a variety of special investigations. Samples:

What ignition system messes up TV pictures worst? How much power does an engine fan use? (Plenty—over three horsepower at speed.) How does a front tire typically throw a stone? (Straight up—then some part of the chassis comes along and hits it.) What happens if power steering quits cold in the middle of a curve at high speed? (You're okay if you don't panic.)

A proving-ground visitor comes away with one clear impression: the guys there work in one of the most refreshingly hokum-free nooks in the auto industry. Not for them is the sales slogan or the blind brand loyalty. What they believe in, instead, is the oscillograph and the strain gauge. END

That'll Teach Him

"What are you putting in your vest pocket there, Joe?"

"That's a stick of dynamite. Every time Dan sees me he slaps me on the chest and breaks all my cigars. The next time he does it he's going to blow his head off."—*Wireco Life.*

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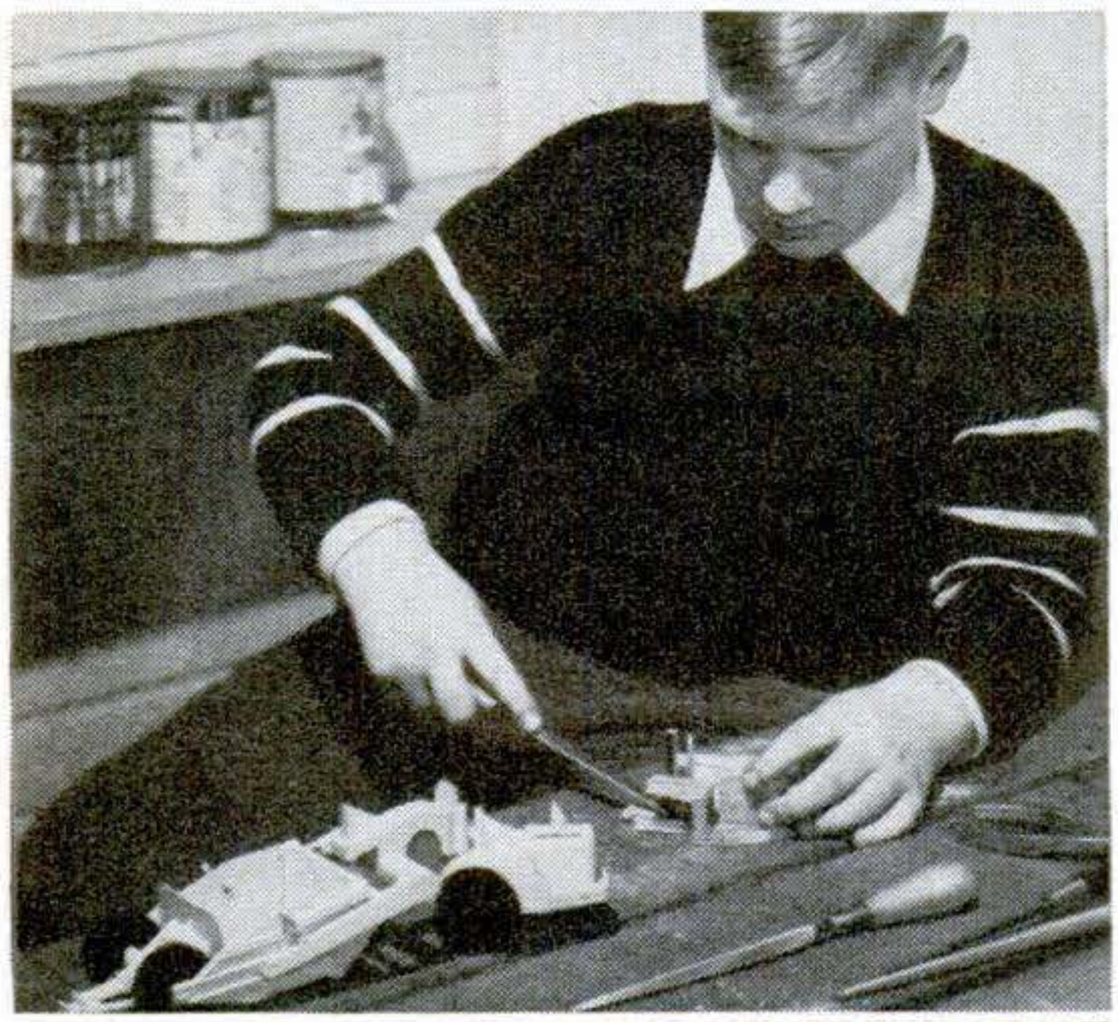
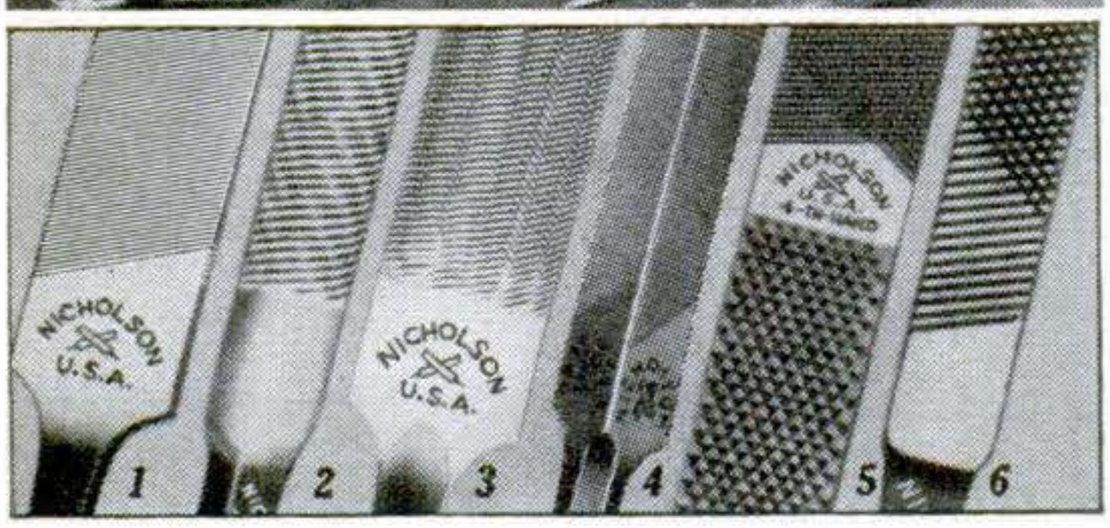
Start 'em young!





"As the twig is bent the tree's inclined." . . . There is no better way to develop a youngster's natural talents than to interest him in "copying things." If he inclines toward mechanics, nothing will please him more than a primary assortment of fine-looking, top-quality Nicholson or Black Diamond files.

Start him off with the types and sizes shown here. They offer both fun and elementary mechanical training. (Dad, too, will get the itch to "make things"—possibly "borrowing" Junior's set for some secret Christmas project while the youngster is asleep.) Your hardware store or industrial supply house has or can get them for you.

1. MILL—single cut flat smoothing file (6" or 8"). **2. ROUND** — tapered type for circular openings and grooves (6"). **3. HALF ROUND**—for concave or flat surfaces (6" or 8"). **4. TAPER** — triangular shape in regular, slim or extra slim type (5" or 6"). **5. 4-IN-HAND**—a combination file and rasp; flat on one side, half round on other (8"). **6. SQUARE**—double cut for slots and other narrow spaces (6").

NICHOLSON U.S.A. **NICHOLSON FILE COMPANY** BLACK DIAMOND MADE IN U.S.A.
23 Acorn Street, Providence 1, R. I.
(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON FILES *FOR EVERY PURPOSE*

Precut Lumber Simplifies Building

[*Continued from page 138*]

"If you consider that neither of us even owned a hammer before we began," says Murnane, "I think you'll agree that anybody who can follow simple instructions can put up a house like this."

A real-estate appraiser recently estimated that their homes could be sold at $19,000 each. They cost $12,000 apiece.

Precut Beams Are Strong

Years ago, some manufacturers of shoddy prefabricated homes gave the entire packaged-house industry a black eye. But now precut houses often are built stronger than the Federal Housing Administration or other Government bodies require. For example, beams two inches wide and eight inches deep will pass FHA inspection for the span covered by the joists in the Jordan-Murnane homes. The beams used were two-by-10, hence considerably stronger.

"They all look alike!" was once another objection to packaged houses. It is no longer true. Weyerhaeuser and other suppliers each offer a dozen or more different models to choose from. And that is just the beginning. Usually you can vary the width or length to suit your own taste. Jordan and Murnane wanted to add a dining room (not in the plan they chose), enlarge the kitchen and garage, and move the cellar stairway to a different place. A Weyerhaeuser consultant made the changes at no extra charge.

Similar Houses Look Different

Even if you submit your own original house plan, some suppliers will precut the lumber for it and if you choose a stock plan and make no changes, you still can express your individuality in many ways. Choice of exterior finish—whether brick, cedar or asphalt shingles, or clapboard—is left to you, as is choice of colors of roof shingles. You also usually can choose the size and kind of windows (casement, double-hung, wood, steel or aluminum).

The Jordan and Murnane homes dra-

[*Continued on page 252*]

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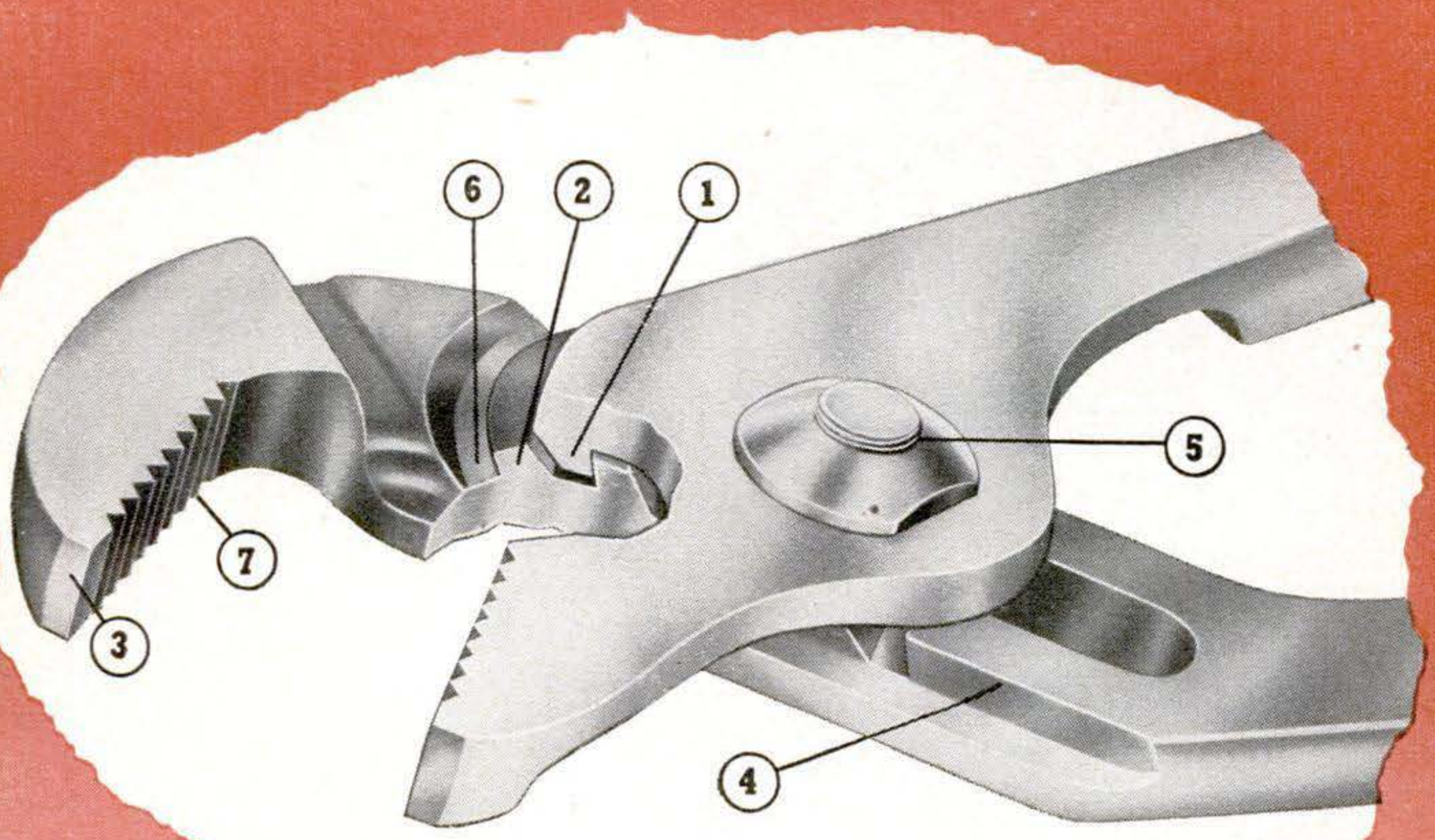
The BEST is now BETTER than ever

THE NEW No. 420 **CHANNELLOCK** PLIER

TRADE MARK REG. U. S. PATENT OFFICE



Look at these NEW features . . .

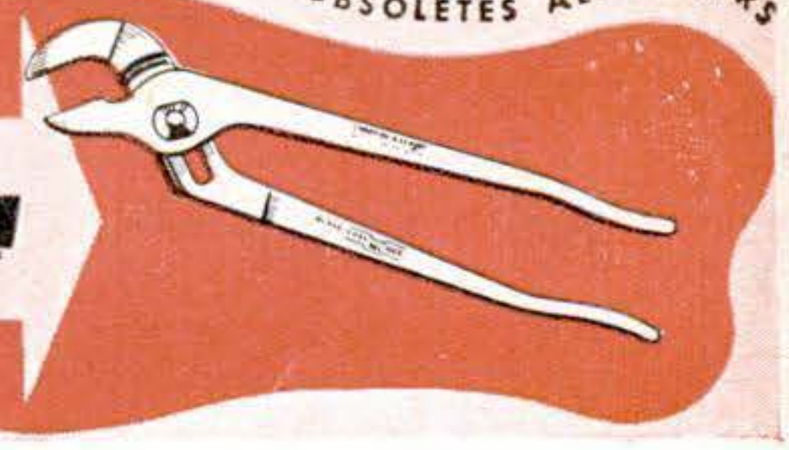
1. Interlocking principle positively prevents slipping under any load . . . the heavier the job, the greater the interlocking action.
2. New type wide base lugs provide maximum cross section strength . . . cannot shear.
3. New nose design provides greater utility for gripping small objects.
4. Patented design of tension edge provides more strength and eliminates stress concentration at channels.
5. New interlocking design minimizes stress on joint bolt.
6. Precision machined interlocking surfaces provide perfect fit, thus distributing pressure evenly.
7. "Rite Angle" teeth guarantee maximum bite and minimum wear.

Here's the new, improved Channellock Plier—bringing to you new features which offer more positive gripping, greater strength and longer wear. The undercut interlocking channel is the first really new idea in plier design in years. Engineering skill has developed a plier with new patented features which give you the newest, strongest, most practical plier you can buy. Here is a plier that will last for years! Channellock Pliers—made only by Champion DeArment Tool Co., Meadville, Pa.

Send for your Catalog today.

Channellock pliers are listed in the Yellow Pages of most Telephone Directories under "Tools"

THE PLIER DESIGN THAT OBSOLETES ALL OTHERS



Only **CHAMPION DeARMENT** *makes* **CHANNELLOCK**

CHAMPION DeARMENT TOOL CO. • MEADVILLE, PA.

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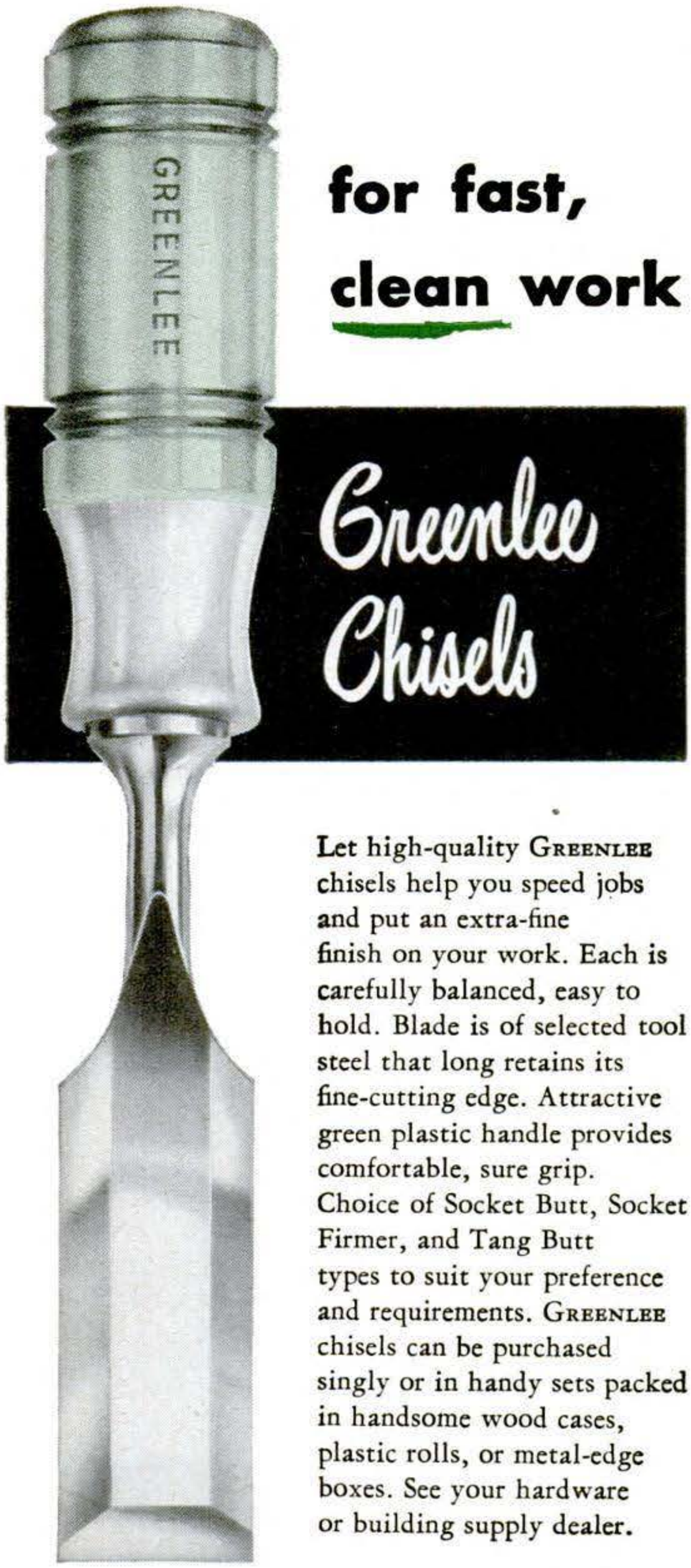

for fast, clean work

Greenlee Chisels

Let high-quality GREENLEE chisels help you speed jobs and put an extra-fine finish on your work. Each is carefully balanced, easy to hold. Blade is of selected tool steel that long retains its fine-cutting edge. Attractive green plastic handle provides comfortable, sure grip. Choice of Socket Butt, Socket Firmer, and Tang Butt types to suit your preference and requirements. GREENLEE chisels can be purchased singly or in handy sets packed in handsome wood cases, plastic rolls, or metal-edge boxes. See your hardware or building supply dealer.

TOOLS FOR CRAFTSMEN

GREENLEE

SPECIAL OFFER . . . GREENLEE Woodworking Calculator only 25c. Converts linear to board feet, gives nail specifications, tool sharpening tips. Compares woods, gives bit sizes for screws, concrete mixes, painting information, etc. Convenient . . . simple to read. 6" diameter circular shape . . . heavily varnished cardboard. Send 25c (no stamps please).

GREENLEE TOOL CO.
2130 Columbia Ave., Rockford, Illinois

Precut Lumber Simplifies Building

[Continued from page 250]

matize how even minor changes give a completely individual look. Jordan's home has a clapboard front and sides, painted red; Murnane's, a stone front with shallower, blue-gray clapboards on the side. Roof lines of the garages and colors of roof shingles are different. Only a highly experienced eye could detect that the two homes have the same basic plan.

What is the most important requirement for a weekend builder? I have spoken to many others who have built their own homes, and they agree on this point: know what jobs you can do and, more important, *what jobs to leave to experts.*

You'll Need Some Skilled Help

Anybody with a set of muscles who can count to five can mix concrete. An eight-year-old can hammer nails. Given a few minutes' instruction, novices can apply insulation, erect plasterboard walls, lay asphalt, rubber or plastic floor tile, calk windows, paint the house and prepare and seed the grounds.

But, unless you are specially trained, you may have trouble if you try to install your own plumbing and electricity. Many communities require that only licensed workmen make these installations. Some skilled handy men have laid their own foundations, fireplaces and chimneys, but the average person may find it safer to hire experienced masons.

There never was a completely painless way to construct a house, and probably never will be. No matter how you build, you will face annoying problems, frustrating delays, unexpected expenses, and possible disappointment if some part does not turn out as well as you expected. But precut houses do take *some* of the headaches out of home building. END

Short Circuit

Garageman: "What can I do for you, lady?"
Lady: "They say I have a short circuit. Could you lengthen it while I wait?"—*Pure Oil News.*

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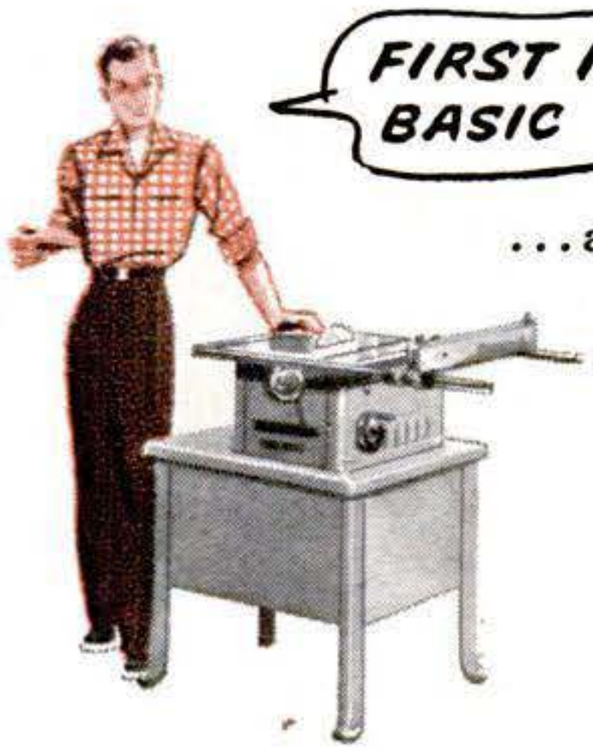
TRY MY "GIFT FORMULA" FOR GETTING YOUR COMPLETE WORKSHOP

Build your one-motor DELTA SHOP *this ideal way—*

A TOOL AT A TIME!



FIRST I BOUGHT THE BASIC SAW AND STAND

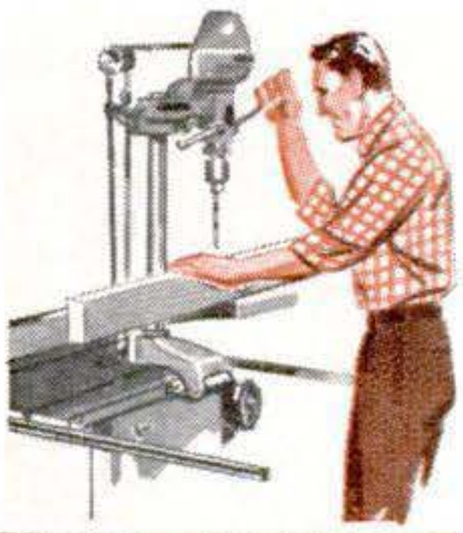
. . . and that gave me the tool to do the sawing operations that are needed on every job. The DELTASHOP'S big tilting blade saw does many other important operations, too—such as cutting grooves, decorative moldings, etc.—and its accuracy helps me do work like a professional.

Saw and stand, less motor **$109.80**

LATER, MY WIFE GAVE ME THE COMPANION JOINTER-PLANER

To do any finished-looking job you must plane the edge of a board right after you rip it. The Delta jointer planes boards up to 4" wide . . . does operations such as tapering and rabbeting, too.

Jointer, complete **$49.15**



THE DRILL PRESS WAS A GIFT FROM MY FOLKS

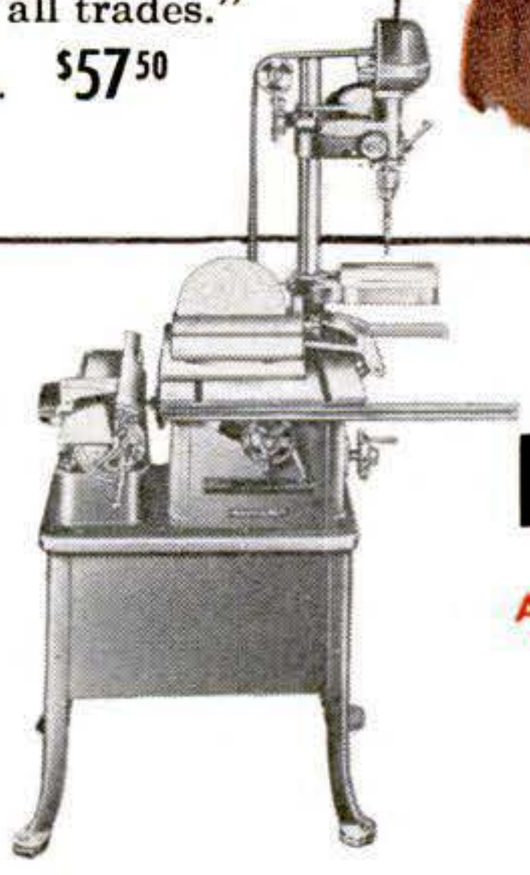
In addition to doing accurate drilling, the Delta drill press made it possible to make mortises, do routing, carving, sanding, polishing, make beautiful shaped edges . . . actually it's a "master of all trades."

Drill Press. **$57.50**

MY KIDS JOINED FORCES TO GIVE ME THE SANDER

This handy, low cost tool is perfect for finish-sanding jobs—has many other uses, too.

Sander. . **$17.55**



Ask about the DELTASHOP "tool-at-a-time" plan today—at your Delta dealer, department store or IRHA hardware store. Then start planning your Christmas for this perfect gift. *Delta Power Tool Division, Rockwell Manufacturing Company, 504K N. Lexington Avenue, Pittsburgh 8, Pennsylvania.*

DELTA MILWAUKEE

DELTA QUALITY MAKES THE DIFFERENCE

Prices slightly higher west of the Rockies

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

ROCKWELL

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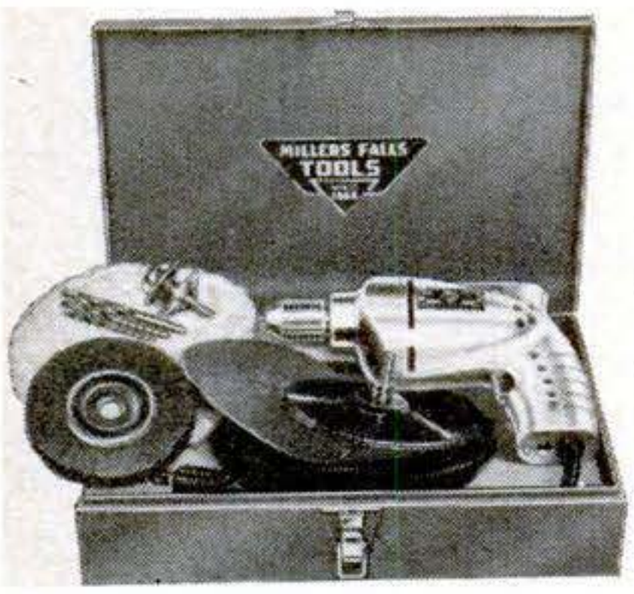
Millers Falls New Pistol Grip ¼-Inch Drill

If you want a really rugged fistful of power — here it is. Weighs only 3 lbs. Drills up to ¼" in steel — to 1" in wood with the new power bits. Available as shown with Geared Key Chuck No. 1814. Or, as No. 814....

$19.85
with Millers Falls Precision Chuck



New Drill Kits

Featuring the new Millers Falls Pistol Grip ¼" Drills, these kits offer a wide variety of accessories and supplies for polishing, sanding, grinding, wire brushing, buffing, etc. Three types available including the...

No. 8140
12-piece Drill Kit
$29.95

BEST BUYS in Electric Tools

Here are just a few of the outstanding work-savers in Millers Falls fast-growing line of general utility electric tools. They're designed and built to give you the last word in performance and value. See them, try them, compare them — dollar for dollar — with any comparable tools. Without question, they're today's best buys.

MILLERS FALLS TOOLS SINCE 1868

The Mark of Superiority

Buffing and Sanding Attachment

Fits any ¼" electric drill. Saves time and work on polishing, sanding, cleaning, waxing. Two speeds. Exclusive 100° angle drive. Complete with 5" rubber pad, 5" lamb's wool bonnet and two 5" sanding discs.

No. 2120
$8.45

New Right-Angle Drive

A handy new Millers Falls Attachment that fits most ¼" electric drills. Makes it easy to drill in corners, between studs, etc. Handy for driving many other attachments wherever clearance won't permit normal operation.

No. 2130
$4.95

FREE FOLDER

illustrating and describing Millers Falls wide line of general utility electric tools. Write for your copy.

MILLERS FALLS COMPANY
Greenfield, Mass.

Pin Money from Parakeets

[*Continued from page 143*]

that special breeding food is nonsense. Standard parakeet seed, some stuff called "treat" twice a week, some greens, some grit for their crops and cuttlefish bone to furnish calcium and other minerals is all that they need.

If you establish an aviary, don't put plants or bushes in it. Crane's parakeets chewed an expensive mountain laurel to bits. Parakeets don't eat the leaves. They just like to cut them up and watch the pieces flutter down.

Don't breed a pair more than three times a year. They will wear themselves thin nesting and feeding their young. You can keep them together, though. Remove the nesting box and they quit. No initiative.

Don't expect too much from parakeets that have become household pets. When parakeets adopt people, they don't seem to need the company of other parakeets. (My wife and I have got our fingers crossed on Mrs. Micawber.)

Don't buy culls. Some breeders off-load inferior birds at cut prices.

Don't inbreed too much. You'll get dull-eyed birds too dumb to adjust themselves to the problems of modern living.

And don't expect to make a fortune. If you breed three pairs, for instance, your profit for a year may amount to $150 after expenses. That's because you'll dispose of half your birds to pet shops at half the price you'll get from private buyers to get them off your hands.

Parakeets Aren't People

Your life will never be the same after you acquire parakeets. One day at the breakfast table I remarked that Mrs. Micawber was sulking.

"Sulking!" sniggered my kid. "Parakeets aren't people."

The realization was a shock. END

Everybody Makes Mistakes

SIGN on a store housing a bankrupt business venture—"Opened By Mistake."—*Pure Oil News.*

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NOW...save $20 to $40!

8" TILT ARBOR* SAW

ALL METAL TABLE AND BASE

"TILT THE BLADE—NOT THE TABLE"

CUTS 2 x 6's IN 2½ SECONDS

$19.95

Blade $2.95 Extra

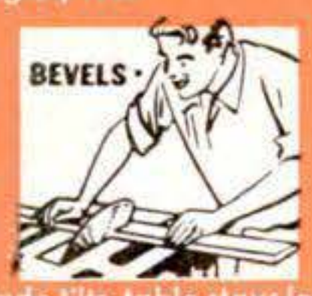
West of the Mississippi $21.95

PLANA CENTRIC POWER TOOLS

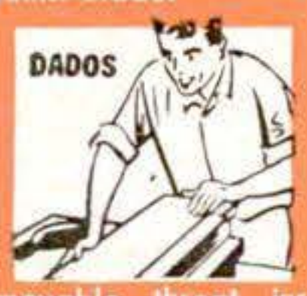
DOES WORK of $60 SAWS

Any length, any type, rough or finished lumber, plywood or composition panels, any thickness up to 2½".

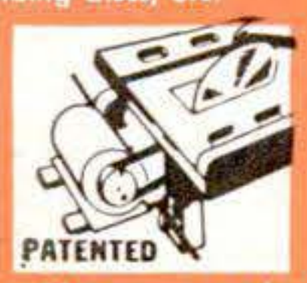
Smooth, accurate cuts from a perfect right angle up to 45° either way, compound angles, too.



Blade tilts, table stays level — safer, no binding because wood doesn't fall against blade.



Removable throat insert lets you use dado or molding cutters, grinding wheels, sanding discs, etc.



¼ or ⅓ h.p. motor rides on ball-bearing rollers, keeps belt tight, transmits full power to blade.

A PROFESSIONAL PRECISION TOOL

ONLY REAL IMPROVEMENT IN TILT ARBOR SAWS IN 75 YEARS!

PLANA CENTRIC SUSPENSION

That's the secret . . . this revolutionary invention slashes costs to the bone yet gives you rugged, accurate, lifelong service. No expensive worm gears or winding wheels . . . saw blade, arbor and tilting-raising-lowering mechanism are mounted on one simple unit that adjusts instantly for height and tilt, locks rigidly, exactly where you set it. That's how it's possible for us to mass produce this professional quality power saw at such amazingly low cost. Buy now . . . While we can hold our price!

MONEY BACK GUARANTEED IF NOT SATISFIED!

*Patent Number 2590035

Rush me your new ALL-METAL 8-INCH TILT ARBOR POWER SAW. I enclose ( ) check ( ) money order for $19.95 ($21.95 West of the Mississippi) plus $1.00 for postage.

Budget if you choose: send $5.00 with coupon, $5.00 per month thereafter. (Your money back if not satisfied in 10 days.)

YOLAND'S PRECISION TOOL CO., Dept. PS10-3
20 Boylston Street, Boston 16, Mass.

Name.....

Address.....

City.....Zone....State.....

If 8" combination Rip and Cross Cut Blade is desired enclose $2.95 extra and check here ( ).

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Typical of the many Starrett precision measuring tools used by machinists, inspectors and layout men are Starrett Surface Gages. No. 257 (illustrated) is a universal surface gage for use on round work or flat surfaces. It has a rotating spindle head, adjustable scriber snug, fine adjusting rocking bracket to permit sensitive positioning of the scriber point, and retractable pins in case hardened base to serve as stops or guides. Available with 3″ base and 9″ or 12″ spindles; also 3¾″ base with 12″ or 18″ spindles. Ask your industrial distributor.

SEND FOR IT — ONLY 10¢
Starrett "Tools and Rules" Book
shows the right tools for any measuring job. 50 pages, 100 pictures, helpful reference tables. Address Dept. PS

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WORLD'S GREATEST TOOLMAKERS
Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
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MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES

Gus and the Job That Backfired

[*Continued from page 198*]

tipped Gus off, Stoddard. No man could find all those booby traps in 24 minutes."

A broad grin lit up Gus's features as he took a stride forward and neatly flipped the 10-dollar bill from Stoddard's hands.

Gus Charges $10 for Job

"For exceptional service," he chortled, "the Model Garage charges 10 bucks for 24 minutes. The next time you boys want to play tricks on me, remember it'll cost you money.

"If you had the mechanical sense of a goose you'd know that I'd immediately check the battery ground cable to the frame on a backfiring motor, when the starter wouldn't work even though the battery stood at full charge and starter and starter button checked out all right. When I found you'd put flat washers on either side of the ground-terminal bolt, and painted both washers and bolt with shellac, so there could be no ground no matter how tight the thing was, I smelled a rat. When the motor still backfired, I figured you'd changed the order of the wires in the distributor. When this checked out it was only natural to look for the oldest trick in the business—carbon pencil marks from contact to contact in the distributor. Oil trailing from the back bearing on a car—a car that hasn't trailed oil on my cement as long as you've been buying gas from me, Stoddard—meant only one thing, happening sudden like this: something blocking the breather pipe. It was just plain, common sense."

Stoddard Lunges for Money

Stoddard suddenly lunged for the 10 dollars, but Gus flipped it behind his back, highly amused.

"No you don't," he declared. "It's noon, and you aren't going fishing yet. I'm using this dough to take the gang to lunch. Let's go, the grub's on you. You too, stranger, if you'd like."

"Glad to," the gray-haired man chuckled.

It was a jovial meal. The stranger's name was Art Robler, he told them. He seemed a good sort, and eager to talk about the fishing to be found around the town. In fact, he said that he'd like to go along with Stoddard and Pete, if they'd give him time to get his gear from the hotel. Gus couldn't go fishing. He had to go back and relieve Stan

[*Continued on page 258*]

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Yes, you can save $25, $30 or more on every room by installing Aristoflex yourself. It's easy, too, with MATICO's tested install-it-yourself method—special tool kit—and illustrated instruction booklet. And you can install Aristoflex in any room from basement to attic because it's rugged vinyl-plastic throughout —there's no felt backing to wear off or deteriorate.

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ORIGINATORS OF IMPACTOOLS—AIR AND ELECTRIC

Gus and the Job That Backfired

[Continued from page 256]

Hicks, so that worthy character could go to lunch himself.

During the afternoon Gus found himself chuckling over the deal the boys had rigged up on him, and the way it had backfired on the jokers themselves. What a gag!

The phone rang. It was Hal Stewart of the Chamber of Commerce.

"Hello, Gus," Hal said. "Got good news for you. Looks like the town's getting a new business."

Gus Gets the Low-down

"You don't say," Gus told him. "How come?"

"Well, it's this way," Stewart said. "There was an outfit that was thinking of making headquarters in the valley for a small trucking business. They couldn't make up their minds whether to settle here or in Stanfield. We've been working on them for months. You know how we'd feel about losing a new business to Stanfield."

"About the same," Gus chuckled, "as a rat terrier losing a bone to a pack rat."

"Exactly," Stewart said. "So we've been showing the boss man of this outfit around, and without much luck. We thought he'd about made up his mind on Stanfield, but this afternoon he came in and said he'd definitely decided on our town, and had rented the old Murphy storage building for headquarters."

"Good!" said Gus. "What made him change his mind?"

"We don't know, exactly. He did mention that, as they didn't expect to keep a mechanic on, they wanted to settle in a town that had a garage where they could get fast and reliable service when they needed it. Maybe you can get some of the business, Gus. I'll bring the man around and introduce him. His name's Art Robler." END

Modern Music

THE youngster came home from school one day and announced excitedly, "They got a magic record player at our school."

"A magic record player?" asked his mother, puzzled.

"Yes," he explained. "You don't have to plug it into electricity—you don't even use electricity to make it play. All you have to do is wind up a crank!"—*The Right Hand.*

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What every Automobile man should know about

Power Steering

(Number 1 of a Series)

You've probably been hearing a great deal about Power Steering lately. It is attracting more attention in the automotive field than anything since automatic transmission. For the most part, comment has been extremely favorable. However, as with any new product, there have been some misconceptions due to incomplete or faulty information.

That's why we, as the world's largest producer of power and manual steering gears, are publishing this series of messages to help answer some of the questions most frequently asked about Power Steering. Let's start with a basic one.

1. IS POWER STEERING HERE TO STAY? Definitely *yes!* No other major automotive development (not even automatic transmission) has won such rapid public acceptance. Its principles have already been perfected by years of use in heavy vehicles—such as buses, trucks and road-building equipment—and in ships and aircraft.

2. IS IT TROUBLE-FREE AND DURABLE? Again, *yes!* Engineering tests over many years have proved that Saginaw Power Steering will easily outlast the average car with nothing but an infrequent adjustment or addition of oil.

3. WHY IS SAGINAW POWER STEERING SAFER? Saginaw Power Steering is safer because it helps you drive relaxed and tension-free. It resists and absorbs wheel-twist from ruts or chuckholes—enables you to keep your car under safe control even in case of a blowout at high speed. Saginaw Power Steering also provides quicker steering response in any emergency.

Because of its simple and sturdy construction, there's practically *no chance of power failure.* But just in case, you always have the assurance that you can guide your car by manual steering—an extra built-in safeguard that prevents any possibility of loss of control.

Another vital safety feature of Saginaw Power Steering is the comforting *"feel of the road"*—the subject of our next message.

MEANTIME—if you'd like to learn more, we'll be delighted to send you "THE *FACTS* ABOUT POWER STEERING"—an interesting little booklet we've prepared to help give you a better understanding of this important new development. It's yours for the asking—just use the handy coupon.

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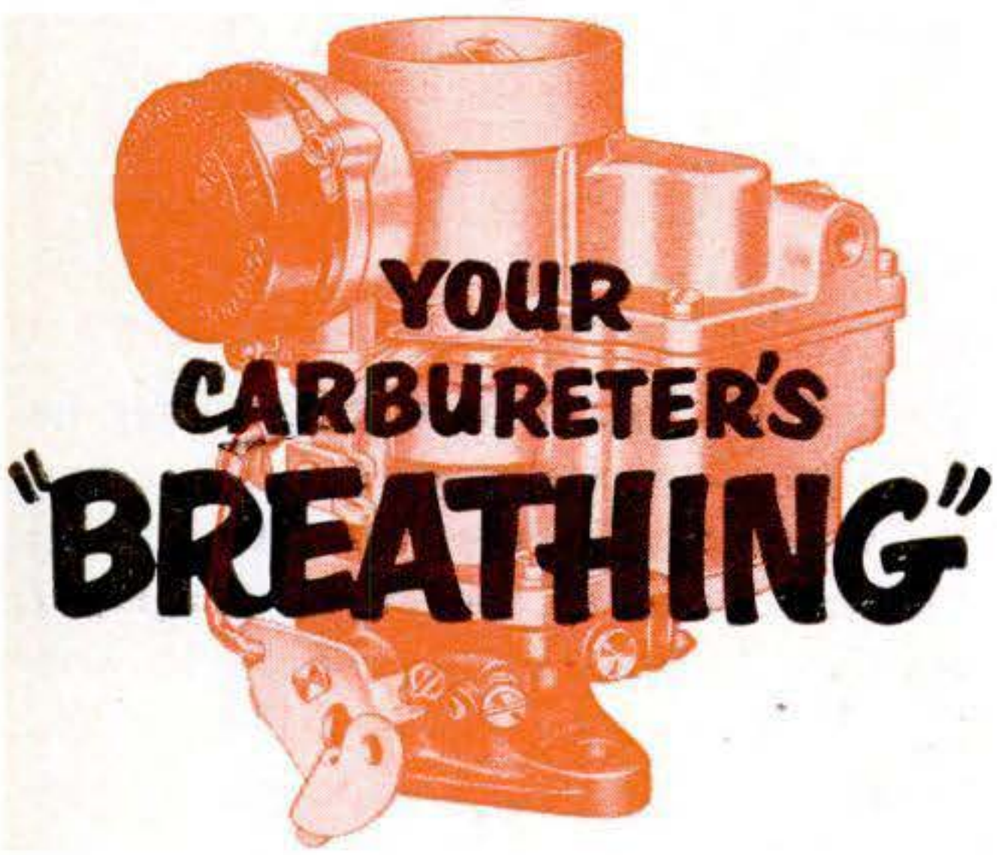

For maximum power and fuel economy in your driving, exactly the right proportions of air and gasoline must be mixed. In order to do this, your carbureter must "breathe in" more than a roomful of air for every gallon of gas used.

enjoy
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CARTER CARBURETOR CORPORATION
St. Louis 7, Missouri
Division of American Car and Foundry Company

Riding the Mightiest Tail Wind

[Continued from page 113]

were made in the winter of 1951-52, with no passengers aboard.

At this point a navigator-pilot, Will Brown, made an important contribution. Brown had been out in the Marianas when the B-29 pilots first flew head-on into Jet Stream trouble. Called back into service by the Air Force after the Korean outbreak, he flew hospital evacuation planes, saved hundreds of hours by riding the Big Wind across the Pacific. He has helped Pan American meteorologists and other technicians figure out how to get into the stream with the least turbulence and how to pick up the most tail wind with the least expenditure of fuel in getting upstairs.

Planes Stick Closely to Timetable

This technique has worked so well for Pan American that all but one of the 35 flights flown last year reached Honolulu within 18 minutes of ETA—Estimated Time of Arrival.

At present Pan American Stratocruisers flying the Jet Stream are utilizing only part of its push, however. This is because CAA regulations permit the Stratocruisers to fly no higher than 25,000 feet. If they could fly above 30,000, the skyclippers could pick up an additional hundred miles of "free-ride" tail wind. They might operate upstairs in summer, thus utilizing the Big Wind the year around.

Unfortunately, higher upstairs the Stratocruisers would lose efficiency unless equipped with more powerful superchargers to compress the thin atmosphere for the engines. These souped-up superchargers are being built, and when they have been tested, the CAA altitude limitations will no doubt be lifted. The Stratocruisers also need souped-up heaters to counter the intense high-level cold —minus 50° to minus 75° Fahrenheit.

"Come back in a couple of years, when Jet Stream cruising will be all-year routine flying," promised Serebreny. "We will land you in San Francisco before you leave Tokyo." END

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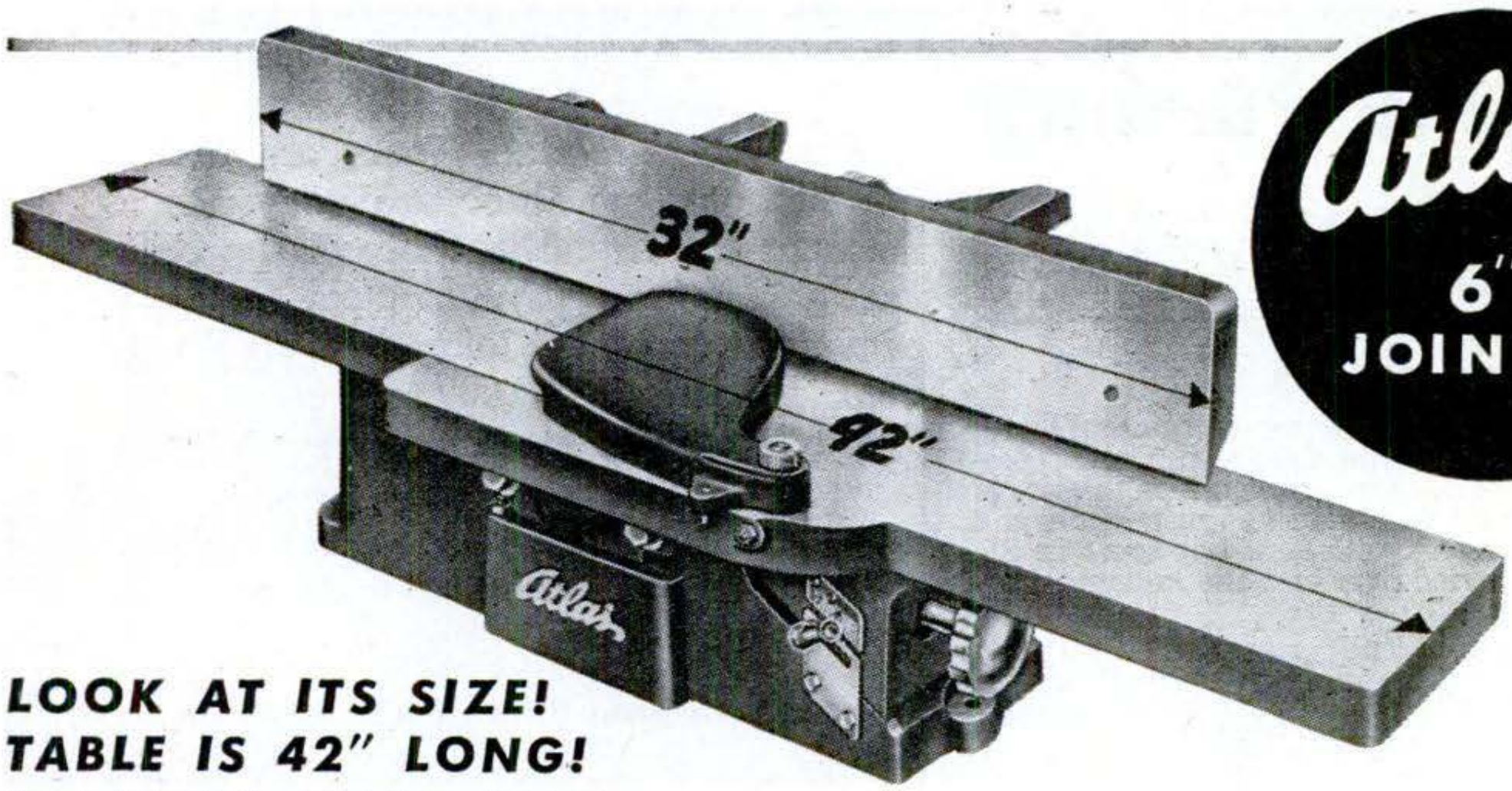

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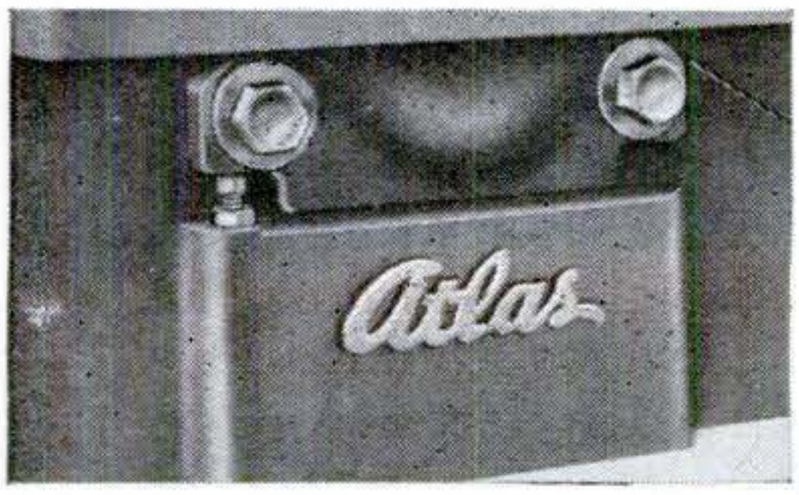
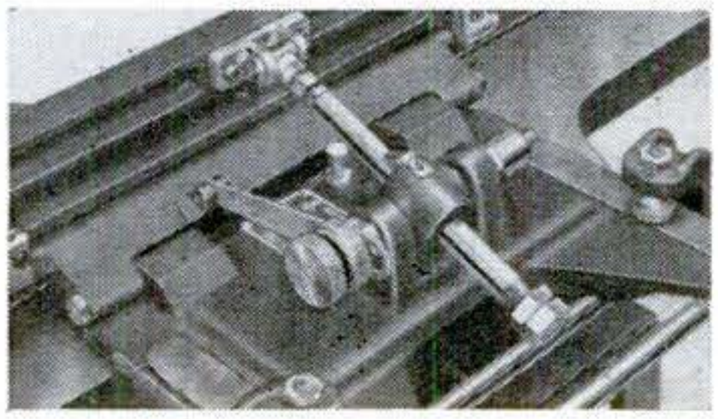
Do a BETTER JOB of Building or Remodeling with this Big *Atlas* Jointer

Ready to handle all your planing, beveling, edging, and rabbeting — cut step mouldings — give your work an accurate, satin-smooth surface in seconds! . . . this Atlas 6" jointer-planer can save you plenty on work for your home. It's big enough to finish out a house or remodel a room — has the accuracy you need for the finest cabinets and furniture. The exclusive cutter head, sealed-for-life ball bearings, and massive table and fence are but three of its many outstanding features. Send the coupon below *today* for a free Atlas catalog with *complete* details.

QUICK, EASY BLADE ALIGNMENT!



Blade-height adjustment screws permit quick, accurate positioning of cutter head and blades. Accurate alignment with the stationary rear table is a quick, easy job.



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Front table adjusts fast and accurately to scale graduated in 16ths. Rear table is *stationary* — always in perfect alignment. *Exclusive* width-of-rabbet scale graduated in 16ths! Fence tilts 45° both ways, has positive stops.

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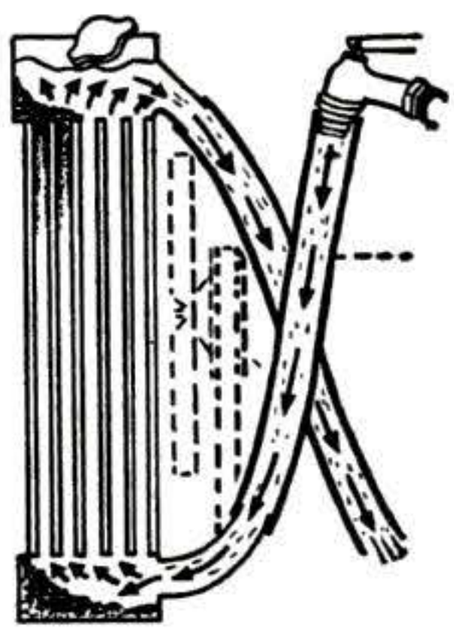
Care and Feeding of Engines BY S. P. CORP

COOLING SYSTEM CARE

All that water you put in your radiator during warm weather contained lime and minerals. These, combined with engine heat, form scale such as you see in the bottom of a teakettle, as well as rust. Scale and rust in the engine block will form hot spots in the water passages. Carried over into the radiator, they clog tubes.



Reverse-flushing of the cooling system should be a seasonal maintenance operation. Do this by removing upper and lower radiator hoses to reverse flush water through radiator. With radiator cap removed, this flow will clear tubes and allow clogged material to drain out at top of radiator. Or you can leave cap on and carry flush stream away through hose attached to upper opening. *Do not apply pressure* until water begins to flow through, then use only normal pressure. If radiator is clogged, use a pulsating flow. The commercial method uses a flushing gun which supplies air agitation to loosen rust and scale.

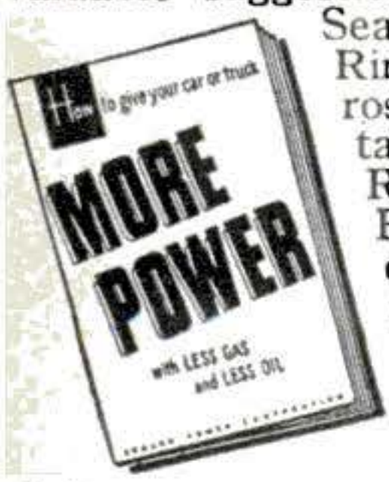
When radiator is clear, connect radiator hose and add a good cooling system cleaner. Run engine until temperature is from 160° to 200°, then stop engine and drain system again, being sure to open drain cocks on side of engine block. Again flush system until clear water comes out of drain cocks.

In extreme cases, remove water distributor tube and thermostat before reverse-flushing cylinder block. On old cars you may need to remove core hole plugs from block.

After thorough cleaning, add rust-inhibitor to the cooling water. Good anti-freeze solutions already contain rust-inhibitors. Avoid salt-base or petroleum-base anti-freeze solutions, as they cause corrosion and deterioration of radiator hose.

FREE BOOKLET ON CAR CARE

Write for free illustrated booklet on car care, "MORE POWER, Less Gas, Less Oil," which contains many valuable suggestions. When you re-ring, insist on Sealed Power KromeX Full-Flow Ring Sets to fight heat, friction, corrosion, and abrasion. These sets contain the famous MD-50 Steel Oil Ring, the only ring with the Full-Flow Spring, best for oil control even in badly tapered and out-of-round bores, for easier starting and thousands of extra miles. Sealed Power Corp., Dept. H-10, Muskegon, Michigan.



Is Grand Canyon's Rival Deeper?

[Continued from page 130]

comparisons of the two greatest canyon voyages he ever completed—Hell's Canyon and the Grand Canyon.

"In the Grand Canyon," said he, "the water drops about 10 feet a mile and in Hell's Canyon about 12 feet. But in Hell's Canyon the descent seems somewhat more gradual. There are rapids, to be sure, but these are not quite as savage and brutal as those of the Colorado. Then, a psychological factor is involved, too. The Colorado is filled with silt. It carries 1,000,000 tons of sand and sludge past a given point every 24 hours. By comparison, the Snake River is relatively clear. Somehow, chocolate-colored rapids seem more fearsome than rapids of ordinary water."

Giant Sturgeon Weigh Up to 50 Pounds

In which of the two canyons would he prefer to be shipwrecked, if he lost his boat and oars?

"In Hell's Canyon, every time," Buzz replied without flicking an eye. He went on to explain:

"The silt in the Colorado has snuffed out virtually all the fish life. But the Snake has many giant sturgeon that weigh up to 40 or 50 pounds. A rope and bent oarlock will do for gear and you usually can find an eel for bait. On top of all this, there occasionally are Chinook salmon in the Snake, up from the mouth of the Columbia River, 600 miles away.

A Gun Would Come in Handy

"I know the pioneers almost starved in Hell's Canyon but there's game there now. If you've saved your gun out of the wreckage of your boat, you'll eat for sure. In addition, Hell's Canyon is easier to climb out of. There are a lot of bluffs and cliffs where it's impossible to get more than a few feet above the river. But a man in good condition could creep upstream or downstream to a slope he would be able to surmount."

Buzz admitted that climbing out of

[Continued on page 264]

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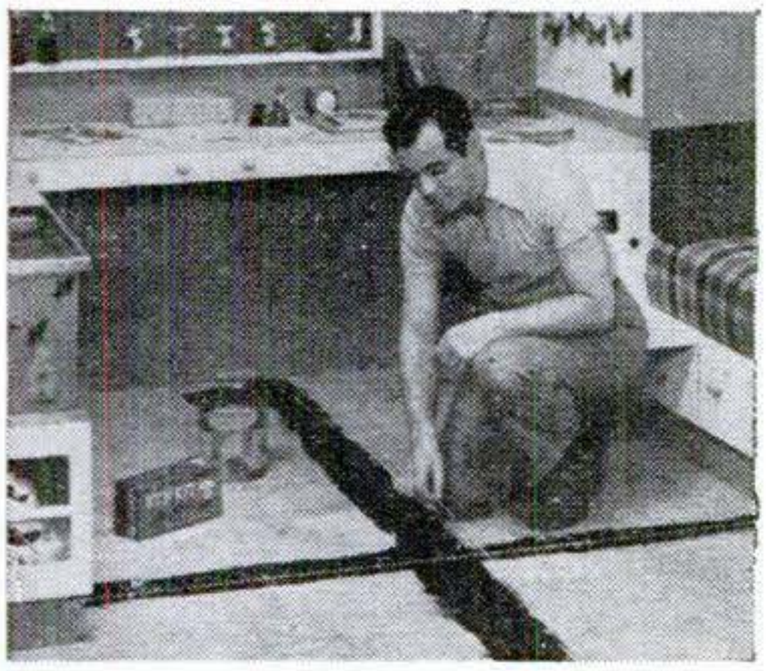

Handy Ken-Kit has complete easy-to-follow instructions—all the tools you need. After floor has been measured, chalk line is snapped. Next, Kentile Adhesive is spread.

Tiles go down one at a time. After first half is done, Kentile Adhesive is spread and tiles set in remaining area. And, once in place, your Kentile Floor is ready to walk on.

A Kentile Floor like this costs $8 to $20 less than tile floors of many other materials . . . yet Kentile is guaranteed!

Kentile's 25 modern colors give endless design opportunities to make your new room the show spot of your home. Kentile is easy to clean with mild soap and water washings ...glows like new with occasional no-rub waxings. Colors never wear off...because they go clear through to the back of each rugged, dirt and stain-resistant tile. Remember, only your Kentile Dealer carries guaranteed Kentile.

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Kentile, Inc., will furnish new tile without charge for any Kentile that wears out and on which colors wear off during your own occupancy of your own home wherein you have installed Kentile or have had it installed by an authorized Kentile Dealer. This guarantee does not apply to damage caused by your improper handling or your failure to follow the instructions for installation and/or maintenance available at your Kentile dealer's. This guarantee must be presented if claim is made for new tile.

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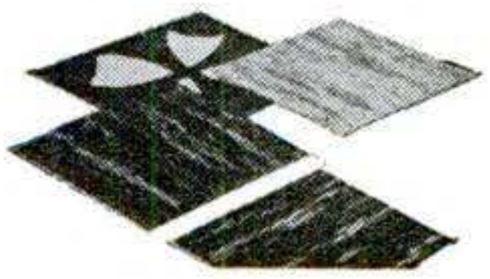

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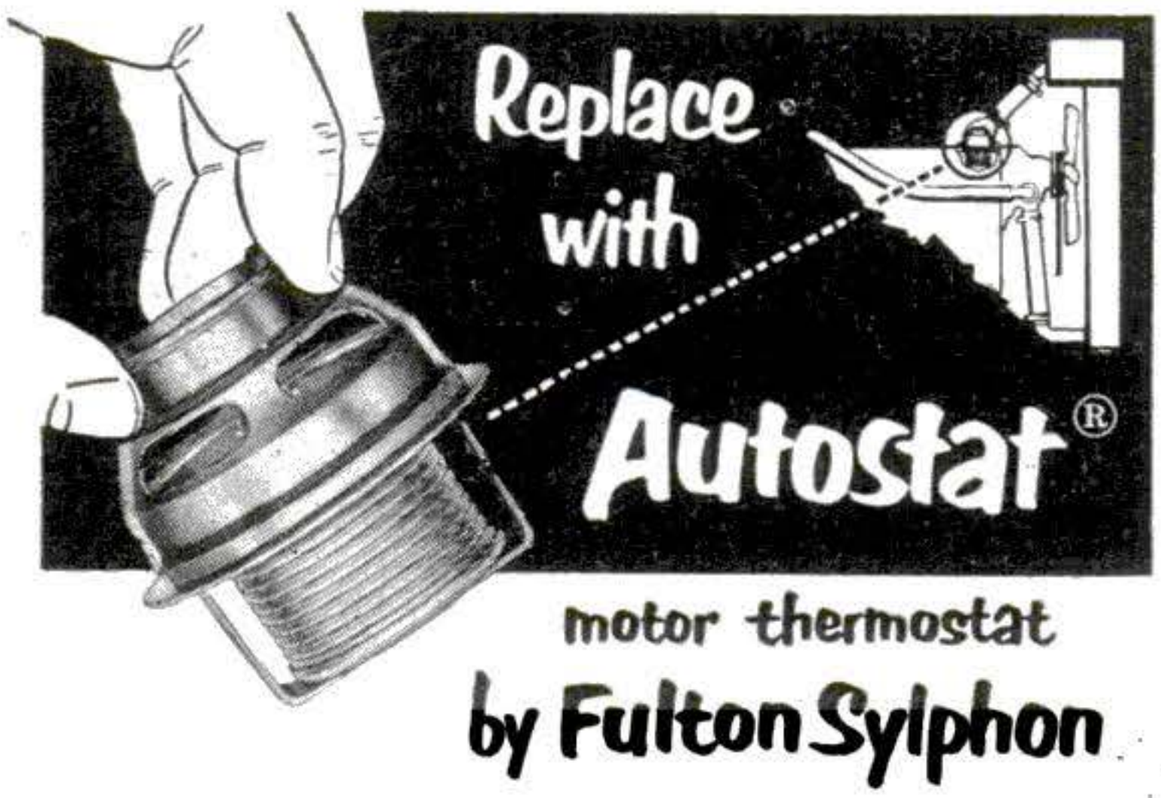
CHECK YOUR MOTOR THERMOSTAT

A motor thermostat that is dirty, damaged or over-age can seriously interfere with the cooling system . . . and this means trouble! The engine over-heats, anti-freeze boils away, gas and oil are wasted — or the engine runs too cold and fails to keep your car heater hot. So get a service checkup on your car thermostat today! And if a new one is needed —



Autostat assures faster starts and faster warm-ups. You get more miles per gallon, more comfort per mile. Save oil and reduce car maintenance. Types for every make and model; quality-made by the pioneer builder of car thermostats.

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CONTROLS COMPANY

FULTON SYLPHON DIVISION, KNOXVILLE, TENN.
BRIDGEPORT THERMOSTAT DIVISION, BRIDGEPORT, CONN.

Is Grand Canyon's Rival Deeper?

[*Continued from page 262*]

Hell's Canyon might be a longer process than escaping from the Grand Canyon because of the mountain ranges involved. "You'd have to cross the Seven Devils in Idaho or the Wallowas in Oregon," said he, "and the snow might be hip-deep or even more in the passes during most of the year. But still I'd take my chance on Hell's Canyon. Its precipices are not nearly as sheer as the inner gorges of the Grand Canyon. I saw the names of men who never reached safety painted on the walls of the Grand Canyon."

River Ends by Atom Bomb Plant

Because the rapids which torment the Snake River are not as turbulent as those of the Colorado, a boat service is possible for 99 miles upstream from Lewiston, Idaho, into the lower reaches of Hell's Canyon.

The Snake erodes a course 1,038 miles long from Jackson Hole in the Wyoming Rockies to its ending in the broad Columbia, beside the Hanford Works, where plutonium for the atomic bomb undergoes its final processing. Hell's Canyon is the river's principal creation. Since the Pleistocene Age the chilly torrent of the Snake has been wearing down the granite, limestone and basalt of the Seven Devils and Wallowas.

They Trekked Over Treacherous Rock

Hell's Canyon divides the two ranges as though some incredible Paul Bunyan had driven a titanic wedge into the earth. It is a canyon of many levels. In 1834 a vagabonding Army officer, Capt. Benjamin L. E. Bonneville, for whom Bonneville Dam on the Columbia is named, attempted to elude the clutches of Hell's Canyon at Squaw Creek Rapids. Bonneville later told the noted author, Washington Irving, that after toiling upwards through skimpy forests and treacherous rimrock for more than a day "and although already at a great elevation, we discovered that we were only as yet upon the shoulder of the mountains."

[*Continued on page 266*]

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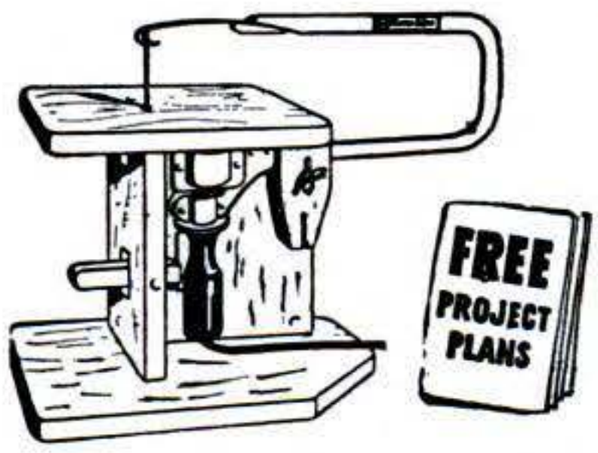

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Here is a genuine craftsman's tool with dozens of household and workshop uses. It is perfect for all sorts of coping and jig saw work, making window valances, knickknacks, hobby projects, etc. Highspeed, reciprocating-type motor easily cuts asphalt and rubber tile, also masonite and formica—wood up to 3/4". Perfectly safe for children—so easy to handle that women love to use it. Has only two moving parts, never needs oiling. A high quality tool used by craftsmen, tile layers, and carpenters.

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FASTEST, MOST POWERFUL TOOL IN ITS CLASS —APPROX. 27,000 R.P.M.

Most practical tool a man can own—more powerful than any similar tool you can buy. Works well in wood, plastics, and metal. For home maintenance jobs you'll wonder how you got along without it. For model making it's a must. And for general shop operations it saves time and money. Compare it, try it, buy it. You be the judge.

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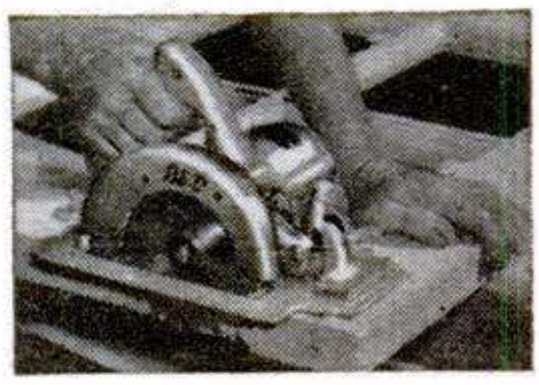
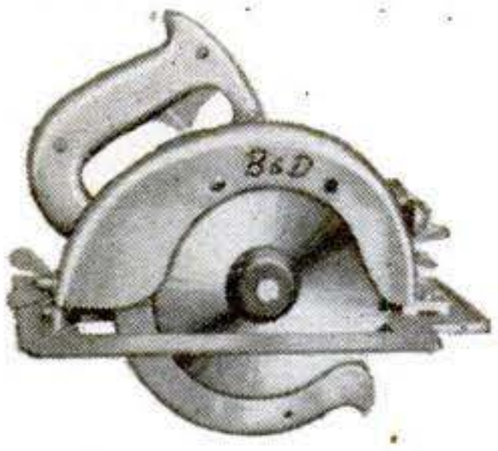
Bob Davis says:

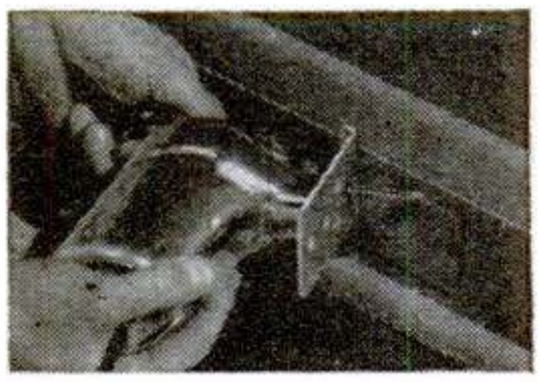
Black & Decker Utility Tools let you do it yourself and save high labor cost!

FOR SNUG FIT on storm windows and doors, trim them at same angle as outside jamb and stiles. Find angle by placing saw shoe against jamb and adjusting bevel setting.





UTILITY 6″ Heavy-Duty Deluxe Saw is 10 times faster than hand sawing. Has built-in depth-and-bevel adjustments, telescoping guard and instant-release trigger . . . **$76.50**



ADDING A ROOM? Install wiring boxes faster! 1. Cut openings in wallboard. 2. Place wallboard against studding to mark positions for boxes. 3. Wire, then nail wallboard.

UTILITY PORTABLE JIG SAW makes curved, straight or irregular cuts in most every material. Cuts own "entrance" hole for pocket cuts in wood. Complete with 5 blades . . . **$49.50**

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Is Grand Canyon's Rival Deeper?

[Continued from page 264]

Hell's Canyon is ribbed by many side chasms, which take off laterally like the wispy bones that connect with the vertebrae of a fish. These offspring gorges are often 2,000 feet in depth, making them considerably deeper than the famous Grand Canyon of the Yellowstone or the Royal Gorge. Some of the creeks bubbling to the Snake are generously populated with Eastern Brook trout, Rainbows, or Dolly Vardens.

Snake May Be Bigger Than Rival

Although the Colorado River growls more ferociously in its prison of rock than does the Snake in Hell's Canyon, the Snake in some essentials is a bigger river than its competitor in the Southwest. The Colorado flows 400 miles farther. Its length is 1,450 miles. It also originates at a higher altitude, thus assuring a more tempestuous search for tidewater. But the Snake has a greater volume. It pours 37,000,000 acre-feet toward the Pacific. This is 20 percent of the runoff of the immense Columbia River system. In contrast, the Colorado's average annual flow is only 16,500,000 acre-feet.

The Colorado splits a plateau as level as a billiard table. A branch of the Santa Fe Railway can extend so close to the south rim of the Grand Canyon that the braying blasts of locomotive whistles echo back from the terraced rock temple known as "The Battleship." But Hell's Canyon is tucked away behind remote mountain ranges. Only narrow dirt automobile roads lead to its brink, and they are not for nervous drivers. One looks out over the dashboard and sees bald eagles flapping in the blue sky. END

For Keeps

A young wife was crying to her neighbor about a quarrel with her husband. "And now," she wailed, "he's left the house."

"Oh, I wouldn't let that worry you," consoled the neighbor. "After all, he's done that before."

"Yes, but this time he took along his bowling ball."—*The Wyatt Way.*

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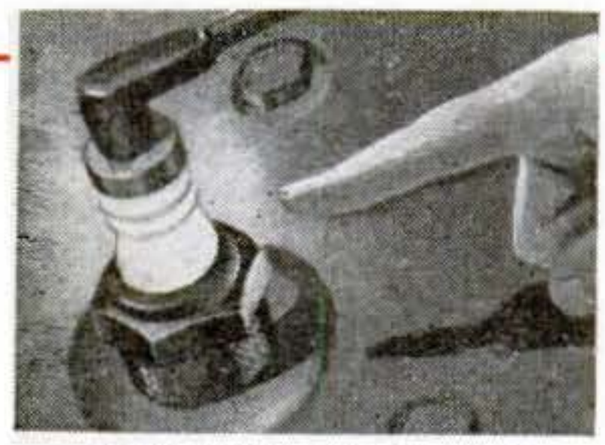
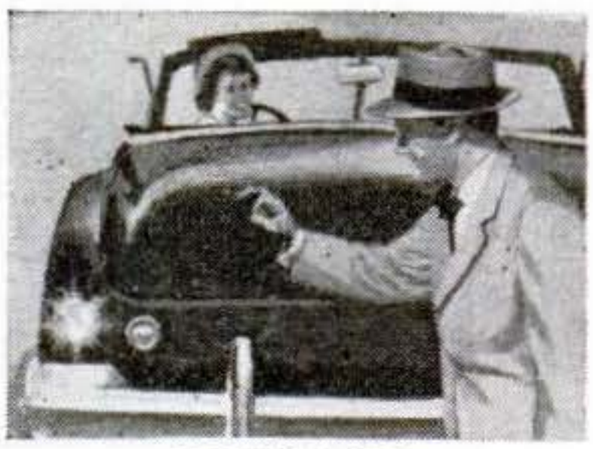
How to get more mileage out of your motoring dollar



WIPE SPARK PLUG PORCELAIN

Guard against ignition failure during damp weather by keeping outside of spark plugs and wires clean. Dirt picks up moisture; causes "shorts"; makes starting engine difficult or impossible; runs down batteries. In this case, as in so many others—preventive maintenance can save you the cost of emergency repair calls.

Check rear lights regularly. Your tail lights, stop lights, direction signals—all have the job of warning cars behind you. Check them frequently to see they are functioning properly. It may save a smashed bumper . . . or a life!



DO THEY LIGHT?

THIS MEANS TROUBLE!

Check your oil filter regularly, too. In 5000 miles—or less—of driving, your filter can become so clogged it can't trap any more dangerous grit and sludge which damage costly engine parts. Get a new Purolator* Refill before that happens. Accordion-pleated, plastic-impregnated element has up to 10 times more filtering area than ordinary filters . . . stops dirt you can't see. The Purolator Micronic* is specified as original equipment on more makes of cars than any other oil filter. There's a Purolator for every make of car or truck. Refills cost as little as $1.60.

*Reg. U. S. Pat. Off.

Check your oil filter every time you change your oil

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Hudson Moves Up in Horsepower Race

[Continued from page 175]

Hudson, by the way, has a lot of company in L-head engines. Nash, Chrysler, DeSoto, Dodge, Plymouth, Studebaker, Packard, Willys, Kaiser, Henry J, Ford, Pontiac and Mercury all manufacture L-heads. Five of these companies also make OHVs. Two of them will switch from L-heads to OHVs for '54.

If there's anything to be entered on the debit side mechanically on this automobile, it's on the brakes. In three stops from high speed I began to get "brake fade." The car wouldn't snub to a halt as it should. The linings and bands revolted against the abuse—evidently not enough brakes to properly control a car with Hudson's speed and weight.

Brake Trouble Is Widespread

Hudson isn't alone on momentary braking deterioration when brakes are used hard. I don't know of a company in the business that isn't experiencing brake trouble. The brake engineers for one manufacturer, planning a boost in horsepower, are candidates for the booby hatch—with their '54 announcement only three months away.

Something will have to be done about brakes. Higher accelerations, higher cruising speeds and ever-increasing car weights are making braking a king-size headache. The kinetic energy reposing in the speeds of heavier cars is stupendous. The Hudson Hornet is 500 pounds heavier than the Hudson Super Six of 14 years ago.

All car weights are up from what they were in 1940, even in the "small" cars.

Better braking will come. It has to. And for the Hornet, I'll bank for a solution to the problem on a conservative company that plods along making better L-head engines that turn on with a roundheaded key.—*Wilbur Shaw.*

Dead Issue

THE next time you hurry and press for time remember the Egyptian mummies. They were pressed for time, too.—*Viking Vacuum.*

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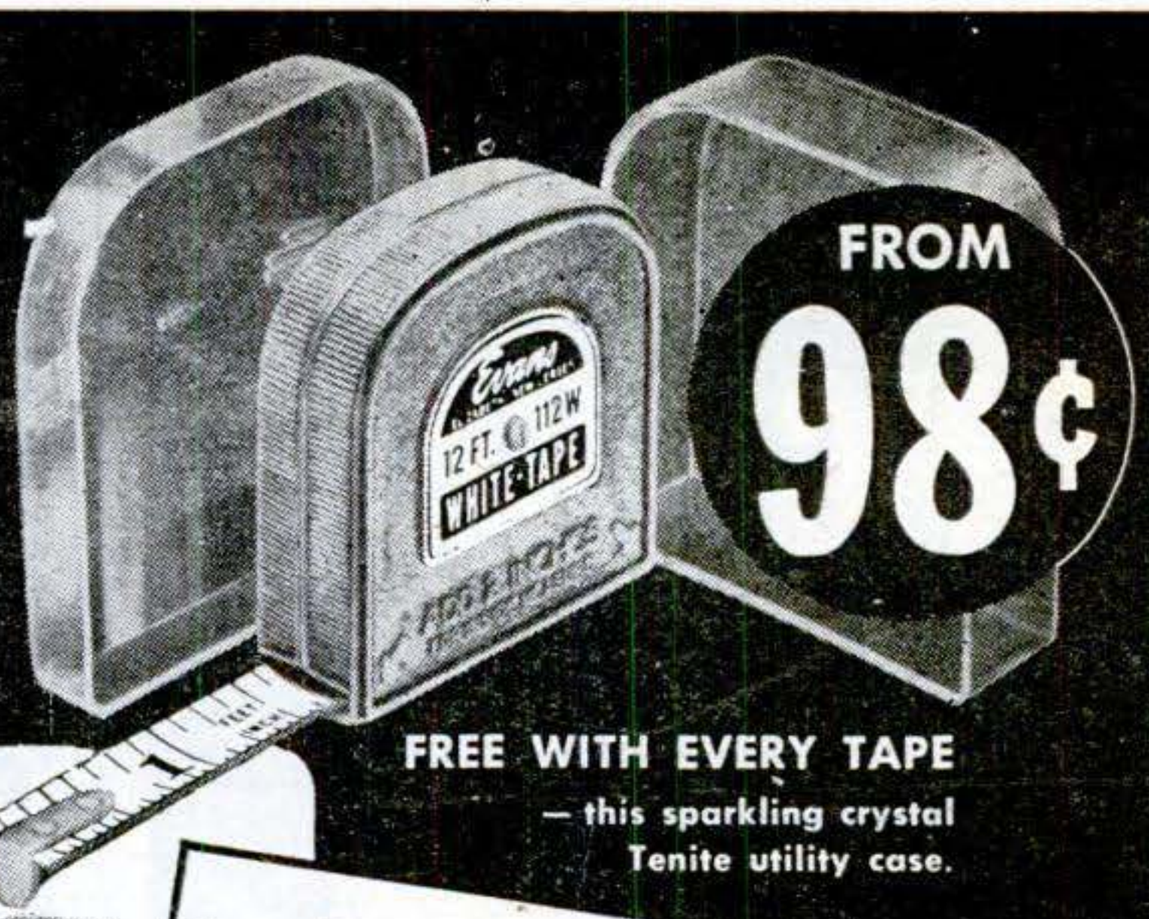

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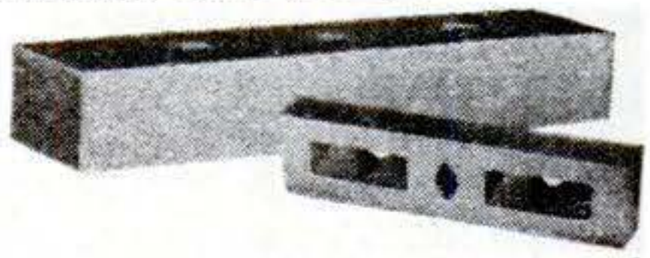

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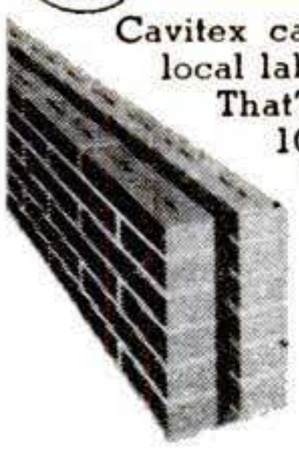

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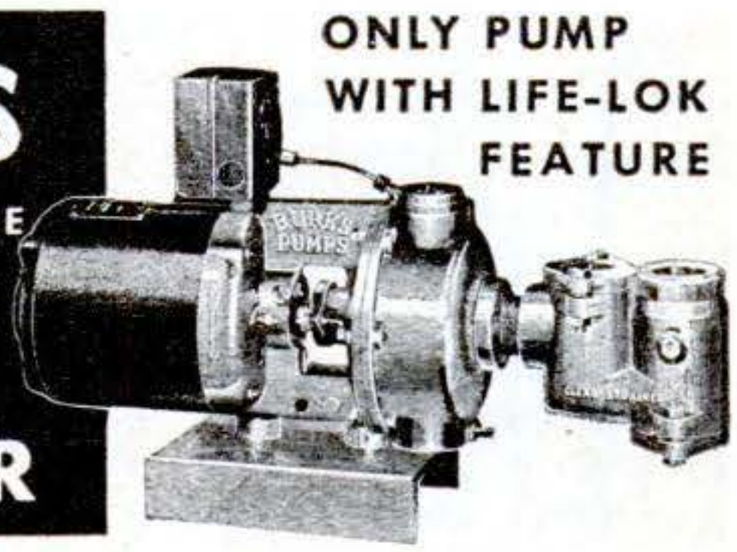

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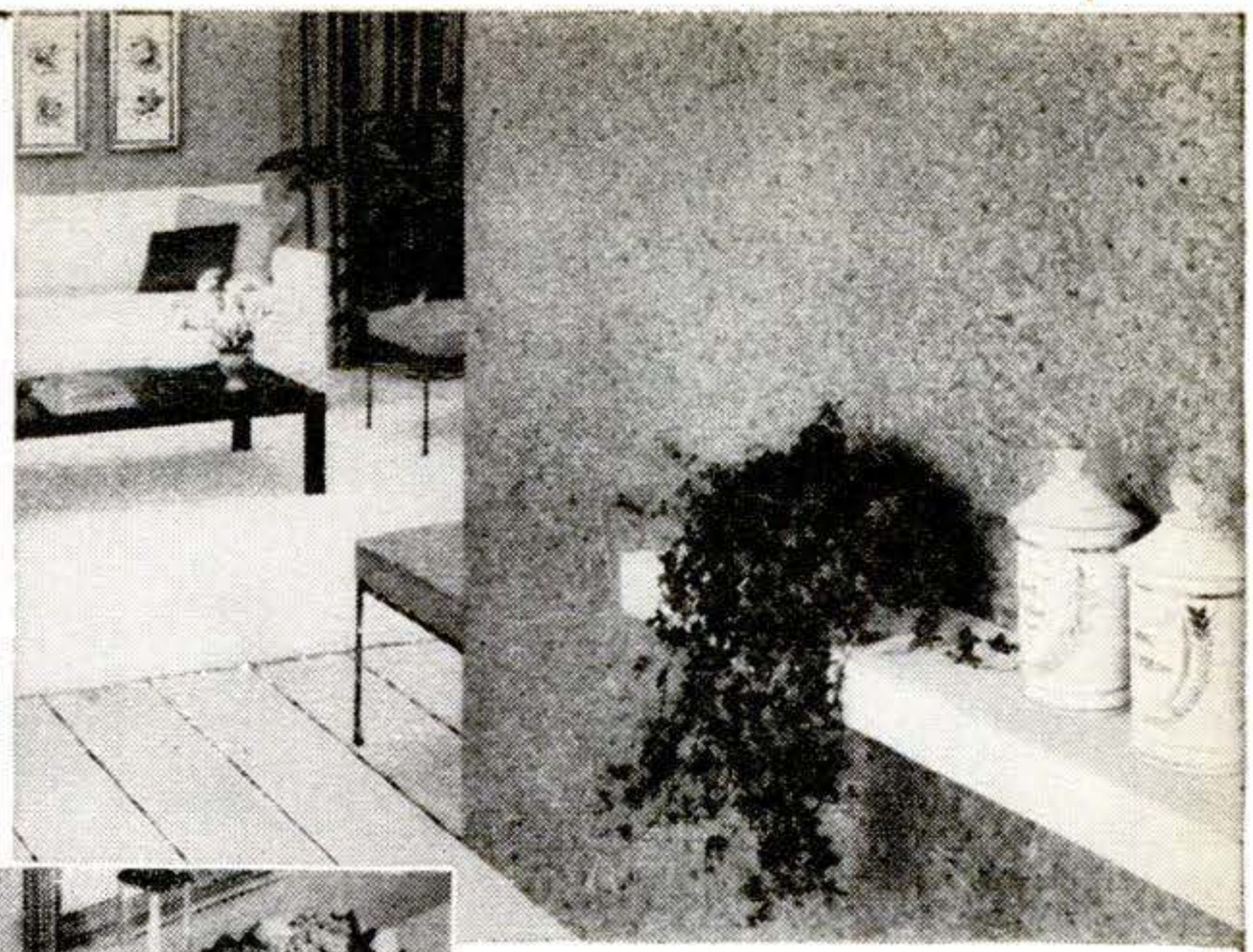

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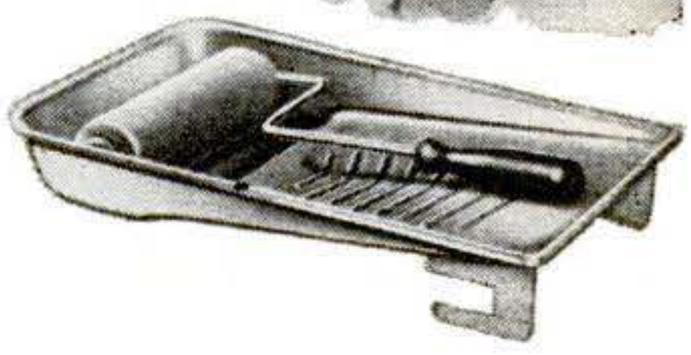

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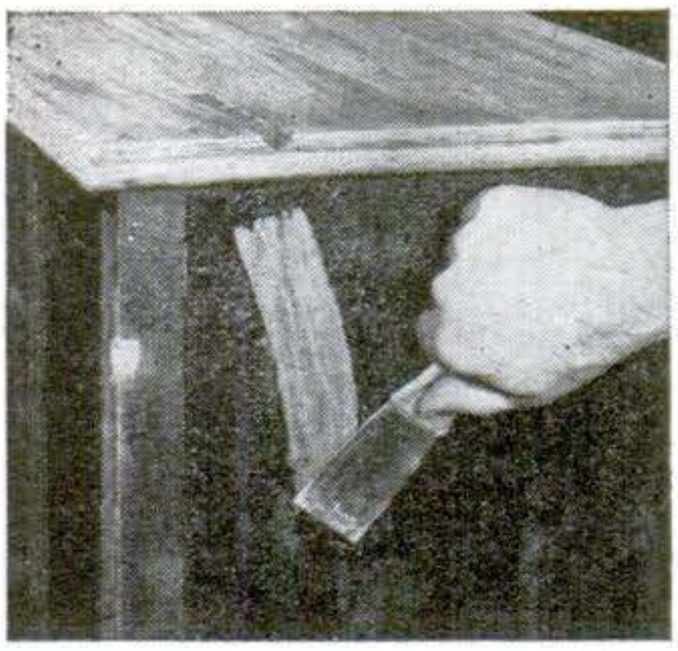
Hints on How to Refinish Furniture



Step 1. *Remove old finish*—quickly, easily, with fast-acting Strypeeze. Brush on, let it set . . . off comes the old finish. (hint: sprinkle sawdust over Strypeeze. "Roll off" sawdust, Strypeeze and old finish.)

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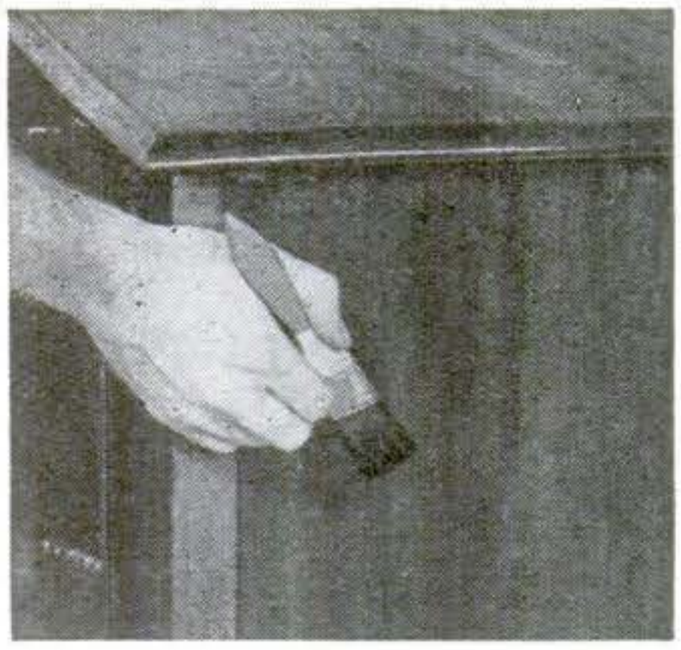

Step 3. *Refinish*—before you start, be sure brush is clean. Savogran Kwikeeze really cleans varnish brushes. Leaves no specks of old varnish, dirt in brush to mar finish. Apply stain, thinned shellac seal, then spar varnish or dull "rubbed effect" varnish in finishing.

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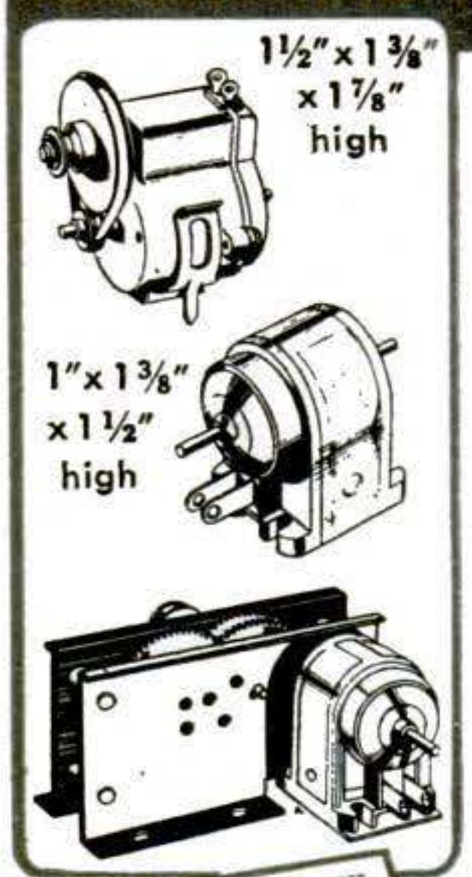

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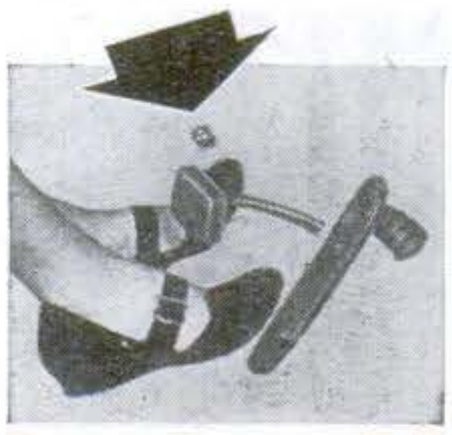

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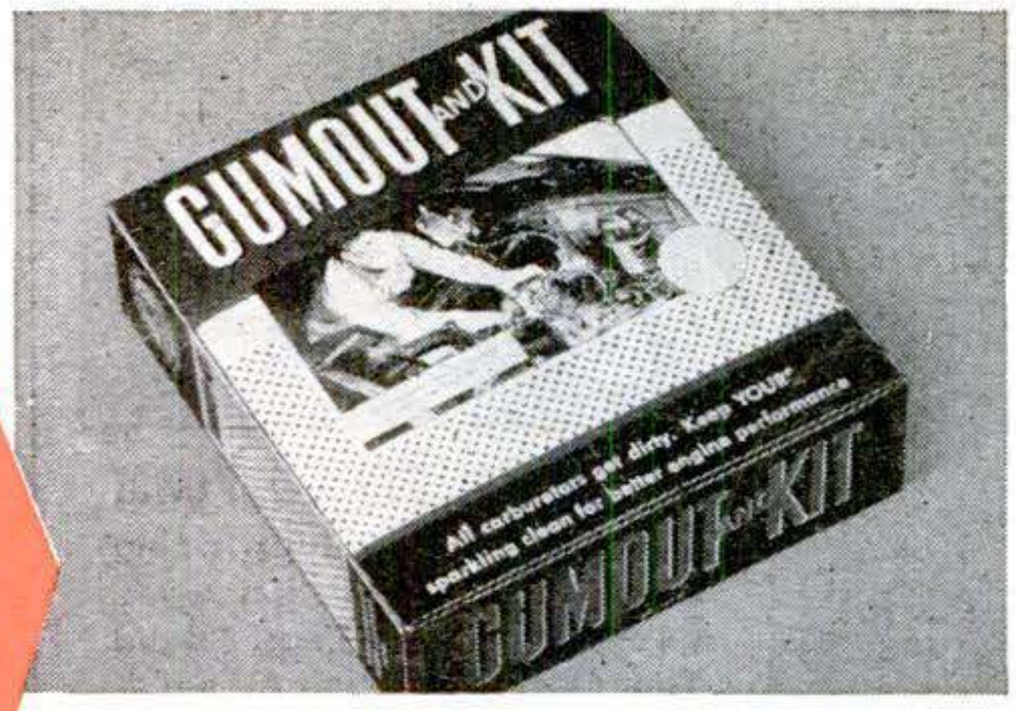

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SAVE $50. OR MORE

Exclusive GIL-BILT Build-It-Yourself Features

- No machining—build easily with hand tools only
- No blueprint reading—step-by-step pictorial plans, full scale patterns, actual photographs
- Sturdy wood, aluminum and steel construction
- Capacity and performance of commercial saws selling for $60 and up
- Proved performance. Nationally advertised and sold for 6 years. Satisfied customers around the world.

GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high, table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run.
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jackscrew mechanism and handwheel, and all other metal parts (less blade).....**$22.95**
Same Kit with 10" Combination Blade **$25.90**
Same Kit with 8" Combination Blade **$24.90**

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings.
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws
- Rigid cast aluminum wheels fully machined ready-to-install. Heavy rubber tires.
- Uses standard 78 inch blades up to ⅜ in. wide.
- Fully enclosed mechanism for utmost safety

GIL-BILT Metal Parts Kit includes Plans, rubber tires, aluminum wheels, ¼ in. blade, ball bearing spindle, tilt mechanism, blade guides, table tilt segments, and all all other metal parts.....**$23.95**

Return Kits in 10 days for refund if not satisfied.

For shipment up to 600 miles, add 5%; over 600 add 10%. Amount in excess of actual postage will be refunded.

Also available—Plans and Parts Kit for 18" Band Saw, Belt Sander and 8" Tilt/Table Saw. Order Plans at $1.00 each—Sent postpaid anywhere in the world or write for FREE descriptive catalog.

GILLIOM POWER TOOLS P. O. Box 1-VK, Lambert Field St. Louis 21, Missouri

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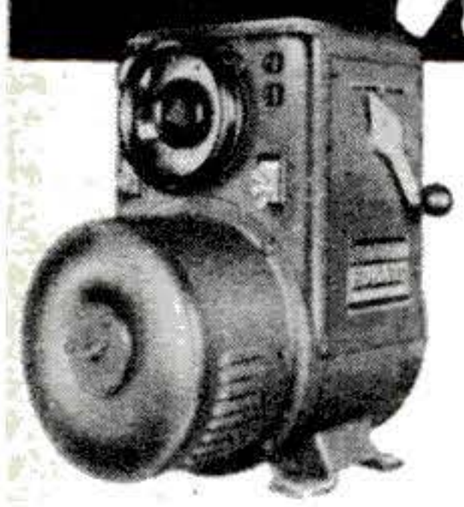
YOU'LL EARN BIG MONEY with HOBART "Simplified" ARC WELDING

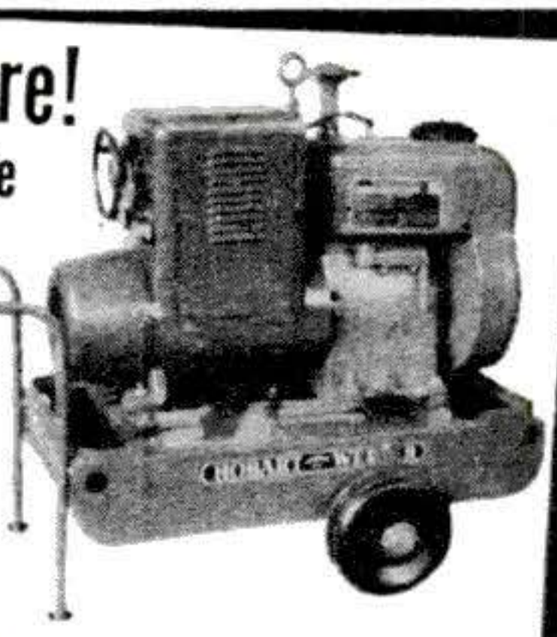


AC Welding and DC Power

Double your earnings doing repair and construction work, away from power lines. "Build Your Own" gives you AC welding—plus electric power for operating tools, lights, etc. Use a gasoline engine, or hook to drive shaft with V belt.

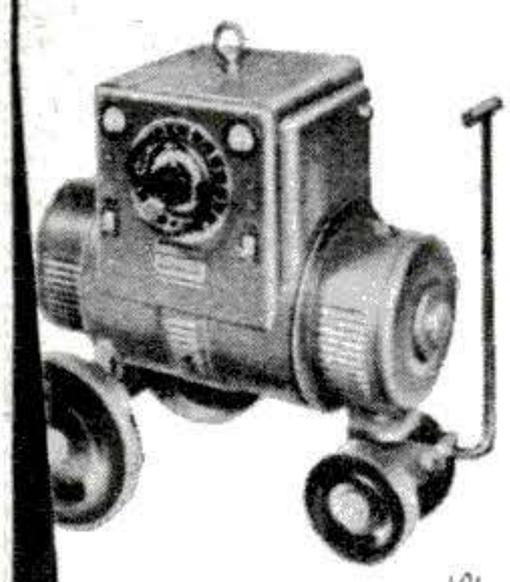
Welds Anywhere!

Air Cooled Portable Engine Drive



With the "Husky Boy" 200 amp. arc welder you can do profitable general shop and outside repair work; emergency service on pickup trucks—all on a low investment. It's compact and lightweight—easy to transport. For extra convenience when used inside, wheels and handles easily bolt to the unit, and are available at slight extra cost.

300 Amp. Electric Portable Arc Welder



Superior performance with true economy should make this welder your choice for 9 out of 10 welding jobs. Remote Control • 1000 Welding Heat Gradations • Oversize 4 Pole Exciter • Sirocco Type Cooling Fan • Vibrationless Steel Shaft • Polarity Control are Hobart features that assure faster, better, low cost welds.

The Hobart Welding School

America's most modern. Every type of training. Equipment latest and best.

You'll like Hobart Electrodes

Hobart's complete line, precision made and rigidly inspected, solves every welding problem.

Hobart Brothers Co., Box P-103, Troy, O.

"One of the world's largest builders of arc welders"

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Send complete details on items checked.

☐ Electric Drive ☐ Gas Drive ☐ Generator Only ☐ Air Cooled Gas Drive ☐ Hobart Trade School ☐ Electrodes ☐ Accessories

☐ *Check here for your vest pocket welding guide*

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CITY_____ STATE_____

opportunity *Now*

ROTO-HOE will show you

BIG PROFITS IN THE POWER EQUIPMENT BUSINESS

TODAY in many cities and towns there is actually a shortage of power garden equipment dealers. This is natural since the industry has grown so fast in the last few years. It's impossible for one or two dealers to represent dozens of farm and garden equipment manufacturers and do a good job for all.

In many areas there's a real opportunity for garden- or mechanically-minded men to sell highly successful, nationally advertised products such as ROTO-HOE. ROTO-HOE's exclusive-territory policy plus its outstanding position in the industry makes selling easy. Tens of thousands sold yearly—enthusiastic customers return to buy attachments. New '54 model ROTO-HOEs will be much in demand for tilling, lawn mowing and edging, wood sawing, spraying, and snow blowing. There are thousands of prospects for ROTO-HOE sales yet this fall.

Get full information on this low cost, high quality rotary tiller and year 'round attachments; we'll show how you can build a successful, growing business around this outstanding power tool. Write today.

ROTO-HOE & Sprayer Co., Box 18, Newbury, Ohio

Mustang

LIGHTWEIGHT $399.33

(Fed. tax paid, at factory)

9.5 hp. 4-cycle. 3-speed. Foot-shift. Over 70 miles per gal. Over 60 m.p.h. Write for free circular.

MUSTANG, Dept. PS
635 W. Colorado, Glendale 4, Calif.

SIGHT LEVELS INSTANTLY!

STRATEX SURVEYING Hand Level

$10 IN U.S.A.

Positive slopes, elevations, drainage—farm, forest or construction. Built for life—simple to use—lets you plan, build, excavate with confidence; adjusts instantly from outside of instrument even in gusty weather! *Put it to work now.* It pays for itself on one job—fully guaranteed. $2 cash, bal. C.O.D., or $10 with order, we pay charges. Saddle leather case included. *FREE* price list.

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MARVEL *Mystery Oil*

- Frees Sticky Valves
- Stops Hydraulic Valve Clatter

Buy it at your favorite gas station

MIRACLE WOOD DRILL

"SCREW-MATE"

1 SET 5 SIZES
3/4"x#7
1"x#8
1 1/4"x#8
1 1/2"x#10
1 1/2"x#12

"SCREW-MATE" does 3-jobs at once. Drills shank and pilot holes and countersinks on wood or plastic. Automatic stop insures 100% holding power. Drills 40 holes pm accurately! High tungsten steel. Fits all 1/4" chucks. Utility Kit, 5 pop. sizes with stand. Postpaid for only **$3.95**

FREE FOLDER "Do-it-better-easier" Tools

Eagle Products BOX 84 A **MERIDEN, CONN.**

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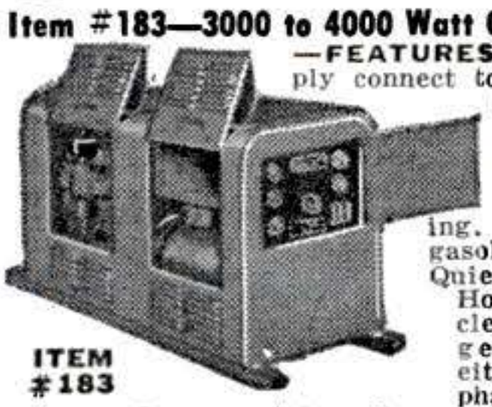
GENERATORS

Many Sizes From 350 Watts to 25 KVA

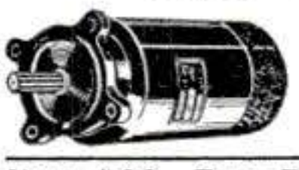
Item #183—3000 to 4000 Watt Generator Set



ITEM #183

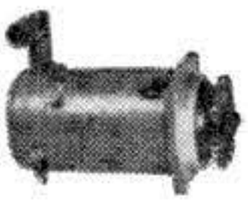
—**FEATURES**—Power for your home or business. Simply connect to power panel or house circuit. ● Constant voltage regardless of load. ● Push button start or stop. ● Easily made full automatic start or stop. **SPECIFICATIONS**—Sizes 19"x30"x48". Steel skids, weatherproof housing, requires no building. Wt. 725 lbs. ● Hercules 4-cyl. 10 HP gasoline engine. Load governor. Oil filter. Quiet muffler, 6-volt starter, generator. ● Hobart 115 volt, 60 cycle, 3000 to 4000-watt generator. Furnishes either single or three-phase power, 2 or 3 wire. ● Panel contains oil gauge, voltmeter, ammeter, circuit breaker, voltage regulator, start button. Today's cost over $1200.00. SALE PRICE, F.O.B. Chicago..... **465.00**

D.C. GENERATORS



Item #176—Type L-3. Rated 25 amps., 24 volts. Manufactured by Leece-Neville Co. Shpg. wt. 30 lbs. Dimensions 12"x6½"x5½". F.O.B. Chicago **16.50**

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost $300.00. Shpg. wt. 55 lbs. Dimensions 15"x9"x6". F.O.B. Chicago.... **22.50**



Item #192—12 volts, 15 amps. For use with external voltage regulator. Model GFU 4105. Autolite D.C. Generator. 4 bolt flange mounting. L 8½", W 4", H 6". Removable drive gear. Shpg. wt. 14½ lbs. $15.00, with voltage regulator **18.00**

Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't. Acq. Cost $380.00. Shpg. wt. 55 lbs. Dimensions 16"x10"x 7". F.O.B. Chicago.. **35.00**

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FREE

FALL EDITION 1953 CATALOG 52 Pages, chuck-full of unsurpassed War Surplus Equipment Bargains for farm, home, factory and workshop. Every item is unconditionally guaranteed. You save on everything! Write today.

ELECTRIC GENERATOR SET—MODEL 2510

Item #2510

2500 watts, 115 volts, 60 cycles, single phase, A.C. electric generating plant, powered by dependable 6.5 H.P. Wisconsin engine—Two pole ball bearing belt driven high efficiency generator with heavy duty windings for high torque motor starting loads. Rated 3000 watts for intermittent service. Light weight portable rugged unit, easily transported to job site. Consumes 3 quarts of gas per hour at rated load. Dimensions: 24"x20"x24", ship. wt. 220 lbs. Complete with fused outlet box box and voltmeter. F.O.B. CHICAGO... **329.00**

Item #178—350 Watt—110 Volt—60 Cycle A.C. Model MS-35-3, made by Midco Mfg. Co. 1 cylinder, 4 cycle engine complete with muffler, starting rope and oil bath air cleaner, direct coupled to a 350 watt generator with voltage control rheostat and twin outlets. Engine speed 1800 R.P.M. Shipping weight 116 lbs. F.O.B. Chicago **125.00**

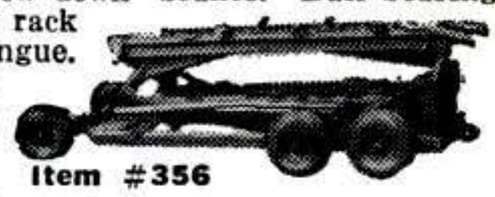
GOV'T SURPLUS! JUST RELEASED!

TWO-TON

6-WHEEL HYDRAULIC LIFT TRAILERS

USE FOR: Conveyor ramp • Boat trailer • Lumber • Pipe • Pole trailer • Machinery trailer • Hydraulic dump for grain wagon • Coal truck • Lift truck • Variable height hydraulic work table • Removable rack permits use of hydraulic lift for other installations.

Outstanding features of these Trailers are:—4000 lbs. payload. 2 individual hydraulic lifts complete with hand pumps & valves. 6—18"x5.5 pneumatic tires. Manual screw-down brakes. Ball-bearing axles. V-shape load rack —8' long. Towing tongue. 54" lift. Wheelbase 98". Ground clearance — 4½"". Tread width—52". Overall width — 58". Overall length including drawbar —167". Gov't cost $685.00. Ship. wt. 1400 lbs. F.O.B. Chicago..... **169.50**



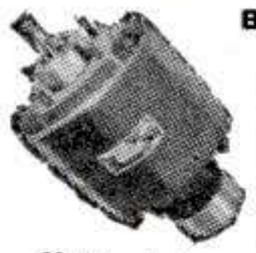
Item #356

Use the adjustable height load rack for boats, lumber, poles or pipe. By adding a plate, you have a ramp adjustable to freight car or truck body height. Add a grain wagon body to the frame for a perfect self-contained hydraulic dump wagon. Mount work-in-process on trailers, permitting adjustment of work height for maximum efficiency. Easy launching and recovery of boats from sloping beaches is done by hydraulically raising and lowering either end of load rack.

HEAVY DUTY HYDRAULIC and AIR EQUIPMENT

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc.

ALL ITEMS BRAND NEW—UNCONDITIONALLY GUARANTEED



Brand New—BERRY—HEAVY DUTY HYDRAULIC PUMP

ITEM #166—Use on farm equipment, road machinery, vibrators, paper mills, wire reels, hydraulic brakes. Ball bearing construction, balanced cam design assures high efficiency performance. When used as a pump; delivers 11 G.P.M., 1000 P.S.I., 8 H.P. At 1800 R.P.M. as a HYDRAULIC MOTOR: Rated up to 12 H.P., up to 2400 R.P.M. Standard ¾" pipe thread ports, ¾" shaft with keyway. Dimensions 14½"x8"x7". Weight 63 lbs. Regular price today $212.00. Our money saving price F.O.B. Chicago, ea. 59.50 2 for **110.00**

Item #166

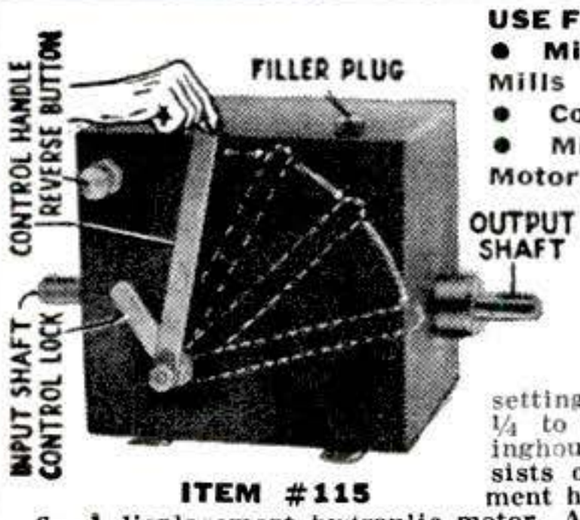
Item #150—Double acting hydraulic cylinder, 2⅜" bore. 12" stroke. Use either foot or clevis mounting. Will lift 4400 lbs. using 1000 P.S.I. Overall length 19½". Shipping weight 8 lbs. Postpaid **18.00**

ITEM #16C—Double acting hydraulic cylinder, 1½" bore, 26" stroke. Will lift 1760 lbs. with 1000 P.S.I. line pressure. Weight 8 lbs. A $55.00 value. Now only.....Postpaid **16.95**

Quick Disconnect Hydraulic Hose Coupler

Item #309—Self sealing, for uncoupling oil lines under pressure. Made by The Brunning Company. Each end threaded for ½" pipe connection. Rugged three piece precision steel construction. 4" long, 1½" dia. Ship. Wt. 2 lbs. Regular price 12.50. Special price each, ppd. **5.75**

HYDRAULIC SPEED REDUCER with FINGERTIP CONTROL



ITEM #115

USE FOR: ● Reamer Drives ● Midget Cars ● Feed Mills ● Canning Machines ● Conveyors ● Lathes ● Milling Machines ● Motor Boats ● Cream Separators ● Garden Tractors ● Pumps

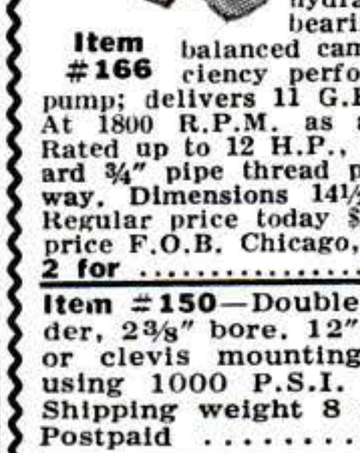
Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of ¼ to 1½ H.P. This Westinghouse-Oil Gear Unit consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Shafts measure ⅝" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speed not to exceed 750 R.P.M. Over-all dimensions, 7½"x 7½"x11½". Gov't acquisition cost $428.00. Ship. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **54.50**

ITEM #126—FOUR-WAY, OPEN CENTER CONTROL VALVE

With built in adjustable relief valve. Factory set at 1000 P.S.I., spring loaded neutral position, for use with one double acting cylinder. In neutral position cylinder is locked and pump unloaded. Fully balanced plunger type, smooth, positive, easy operation. Can be used as single unit or mounted in series of any combinations desired. Has ¾" pipe thread inlet and outlet, ½" pipe thread cylinder ports. Newly manufactured to our specifications. Shipping weight 8¼ lbs. An outstanding buy! F.O.B. Chicago **21.50**

ITEM #126

Item #1036—Double acting hydraulic cylinder, 3" bore, 36" stroke, ½" pipe thread ports. 1¼" solid steel shaft. Overall length closed 49". clevis mounting at base and shaft. FEATURES ● Cup & Chevron Packing ● All Welded Construction ● Precision Ground and Honed Construction ● Will lift 7000 lbs. using 1000 P.S.I. line pressure. Weight (net) 57½ lbs. F.O.B. Chicago **50.00**



Brand New

(ITEM #130)

CENTRIFUGAL PUMP

General Motors — Allison

200 GALLONS PER MINUTE

For Draining Basements • Fire Fighting • Irrigation • Fuel Transfer • Swimming Pools • Home water Systems • Dewatering

For high volume commercial, home and industrial use. Standard 2½" pipe thread inlet, twin 1¼" pipe thread outlets. Ball bearing supported ¾" shaft. Easy priming. Rotation, counter-clockwise facing shaft. Gov't. acq. cost $145.00. Complete with full instructions. Ship. wt. 35 lbs. F.O.B. Chicago **39.50**

Will deliver 200 gals. per min. against 65 foot head using 5.2 H.P. at 3500 R.P.M.

EXTRA HEAVY DUTY

DOUBLE ACTION

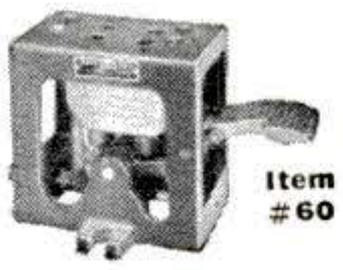
HYDRAULIC CYLINDER

Item #224. 3¼" bore, 24" stroke, will lift 8250 lbs. with 1000 P.S.I. line pressure. ½" pipe thread ports—1⅜" stressproof ground, polished and plated—solid steel shaft. Overall length closed 36". ¼" steel wall cylinder barrel, clevis mounting at base and shaft. Features —Tie Rod construction. Honed barrel. Ship. wt. 50 lbs. F.O.B. Chicago **39.60**

TO PLACE PHONE ORDERS CALL WEBSTER 9-3793

Ross 4-Way Foot Operated

AIR VALVE



Item #60

BRAND NEW—**Item #60**—For double-acting pneumatic devices. Fine for operating presses, air vises, air machinery of many types. Heavy duty cast construction. No neutral position. Maintains pressure against the piston when the foot control is in the "UP" position. Threaded for ½" pipe. Dimensions of valve body: 7¾" long x 4½" width x 7½" high. Net wt. 28 lbs. A $64.00 value for only **19.50** F.O.B. CHICAGO

NEW AIR FORCE SURPLUS

SHATTERPROOF AIR TANK

Item #303

ITEM #303—use for air compressors, surge tanks, CO-2 tanks, liquid containers, floats, buoys. 24" long—4" diameter—½" pipe thread port. Ship. Wt. 10 lbs. F.O.B. Chicago **2.50**

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$19.85 including voltage test leads

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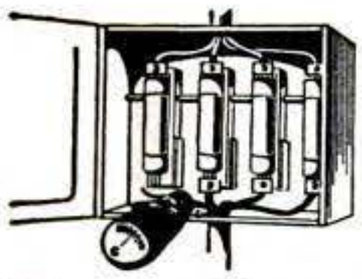
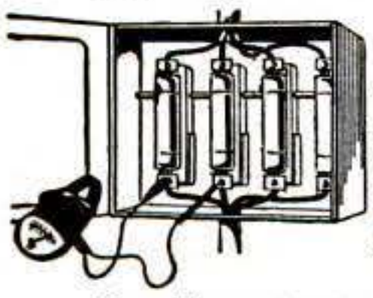
VOLT-AMP TESTER ®

ONE POCKET TESTER DOES THE COMPLETE JOB



IT'S A SNAP-ROUND AMMETER

Measures current instantly without shutdowns or ammeter connections. Just snap the trigger-operated jaws around one conductor (insulated or uninsulated) and you have your reading.



IT'S A VOLTAGE METER

To measure voltage, simply plug the test leads into instrument and clip to load. You get an *accurate* voltage reading on a full-size calibrated scale without doubt or guesswork.

Combines tester ruggedness with instrument accuracy.

YOU PICK THE RANGE THAT FITS YOUR JOB:

MODEL "10"	0-10	AMPS AC	0-150/600 VOLTS AC
MODEL "25"	0-25	AMPS AC	0-150/600 VOLTS AC
MODEL "50"	0-50	AMPS AC	0-150/600 VOLTS AC
MODEL "100"	0-100	AMPS AC	0-150/600 VOLTS AC

With the Amprobe Junior, you can diagnose service calls faster under actual load, check line voltage, determine if wiring is adequate, balance loads, locate grounds, trace shorts, check motor overloads, etc. Ask your wholesaler for a demonstration. For descriptive literature, write to PYRAMID INSTRUMENT CORPORATION, Dept. PS103, Lynbrook, New York. (Export Div.: 458 Broadway, N. Y. 13. Cable: Morhanex).

PAY ONLY $1 A WEEK OR $4 A MONTH!

JUST RELEASED—NEW JET MODEL

All-Metal Electric SPRAY GUN

Save Hundreds of Dollars On Your Painting & Spraying

The new, non-corrosive jet piston action, efficient spray-control dial and eye-level nozzle mean this: just plug in, press trigger and you're painting! Hundreds of tough tasks are made easy. No compressor needed. ALL METAL, including 25-oz. polished aluminum container. Compares with spray guns selling up to $49.95. Clog-proof, fool-proof, trouble-free, this Jet Model is available only from us. Sprays all paints—including rubber-base paints—lacquers, enamels, varnishes, chemicals, oils, insecticides, deodorants, shellacs; for waxing, rust-proofing, waterproofing, etc. Built for heavy duty. AC current. Entire unit, every part, fully UL Approved, including 8-ft. S.J. Neoprene Cord & Plug Set. Included: 5 extra nozzle discs; 232 pg. "Home Fixit Guide." Send $19.95, we pay postage. Or pay $3 down and $1 a week (or $4 a month). 15-day Money-Back Guarantee, either way.

No Carrying Charges or Interest Added! Entire Sprayer UL Approved! 25-oz. Polished Aluminum Container

$19.95 Complete—Nothing Else To Buy!

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2 OR 4 WHEEL DRIVE FOR JEEPS IN SECONDS

AMAZING NEW WARN HUB

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Auxiliary Accelerator Left Foot Gas Pedal Makes Driving a Pleasure

Permits you to relax, and use left or right foot with equal ease.

Fits all cars, either clutch or automatic drive. Guaranteed for life of car on which originally installed.

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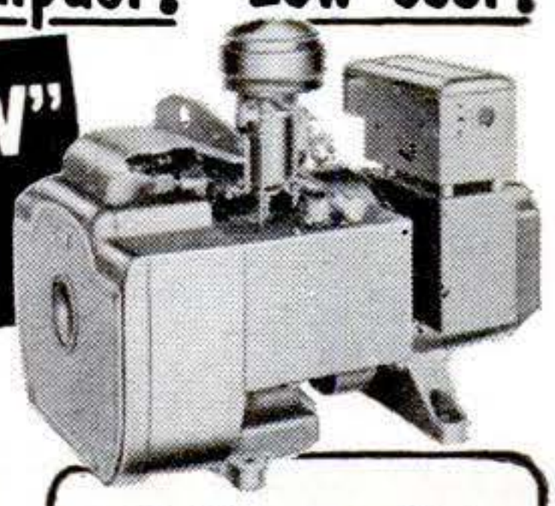
5,000 or 10,000 watts A.C.



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• Quiet-running • Fits in small space • Vacuum air-cooled engine and generator • Lightweight • Completely equipped

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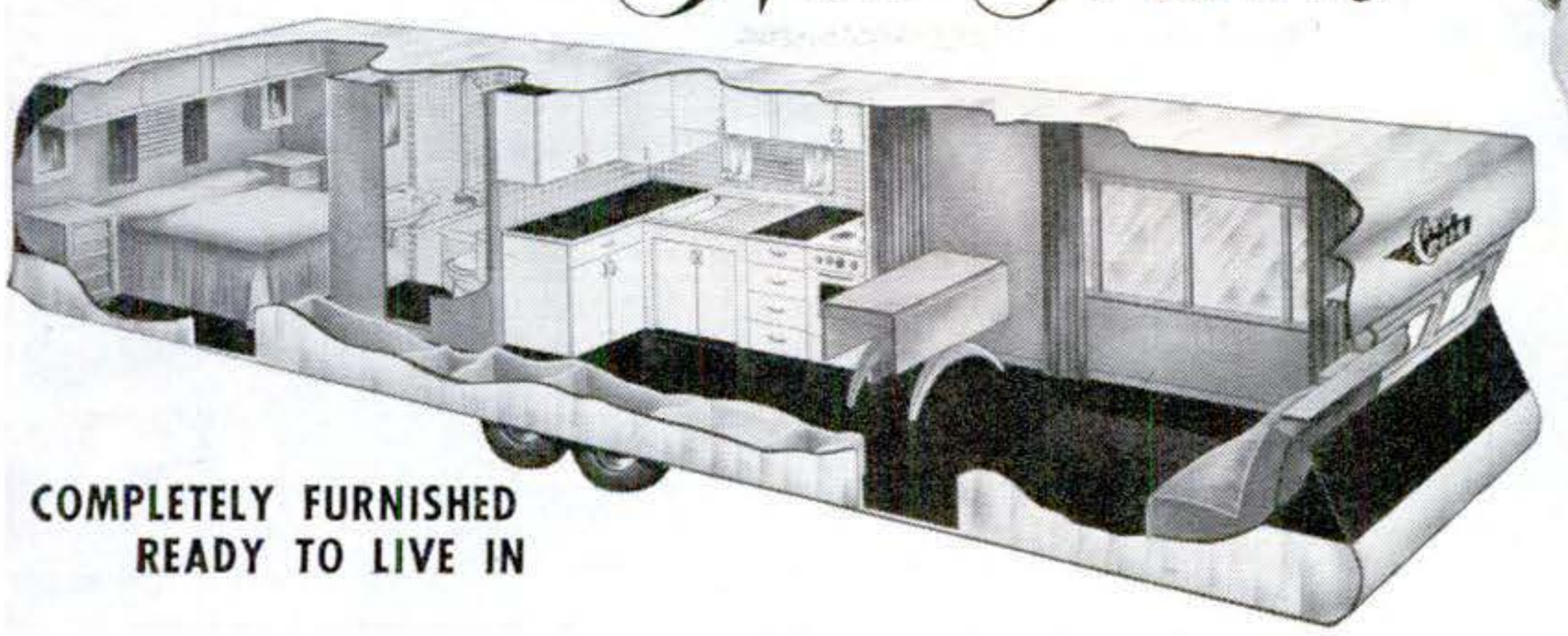

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From its plane stress chassis to its weathertight roof, a New Moon home is tops in built-in comfort. Its thick blanket of insulation, the piano hinges on its doors, the triple trapped enclosed plumbing, its custom cabinet work with mortise and tennoned joining—these are but a few of the many features that make living in a New Moon "carefree." Write for your copy of "Adventures In Living" and learn other advantages.

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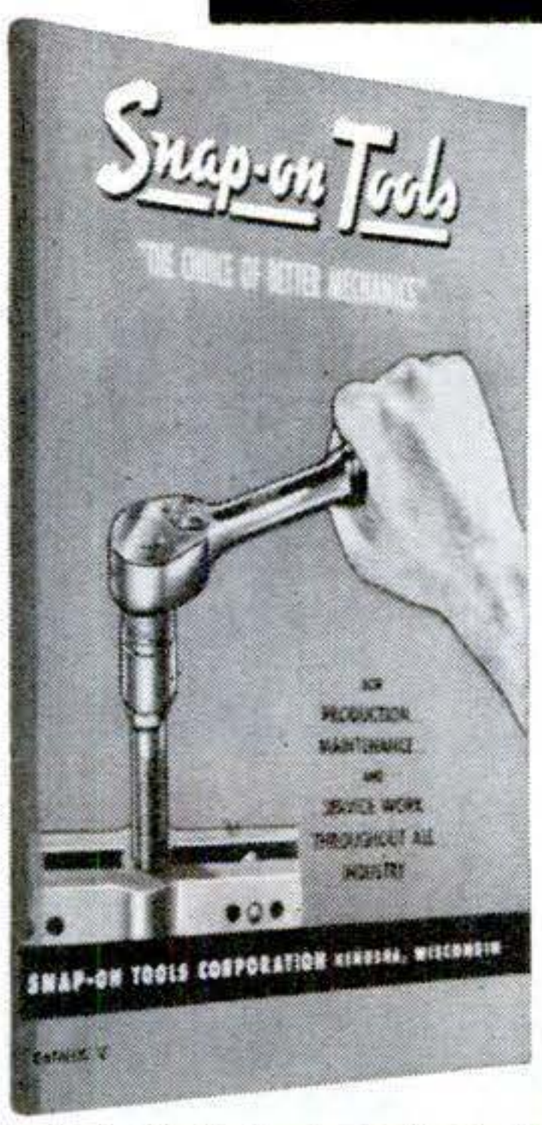

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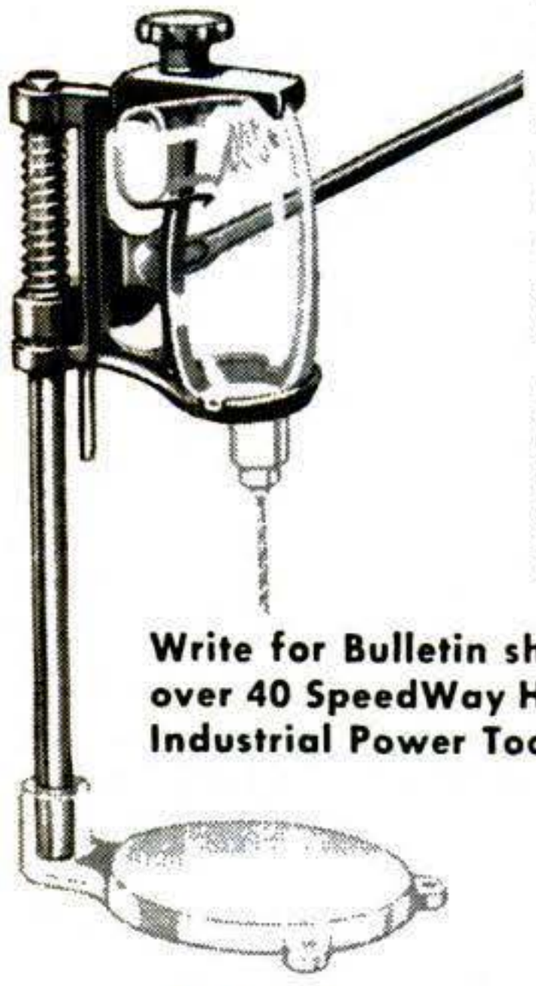

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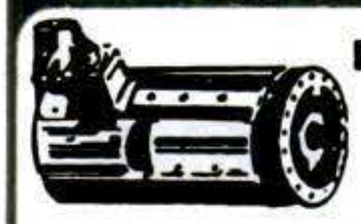

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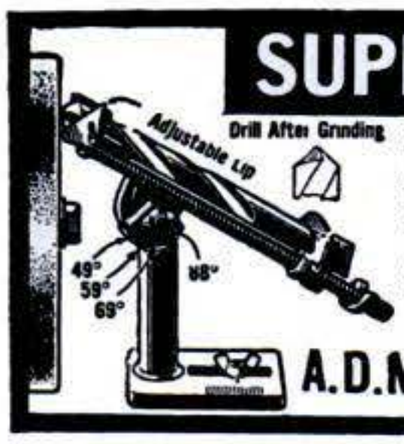

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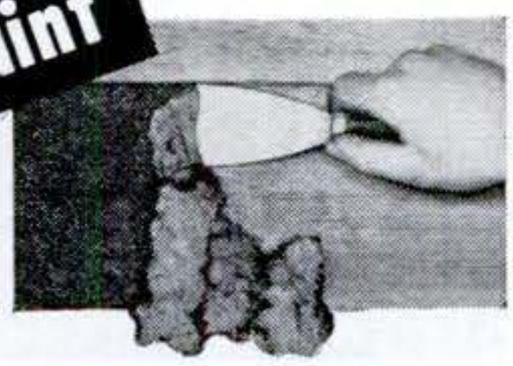

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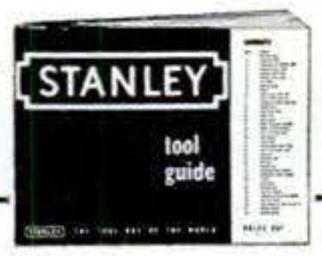

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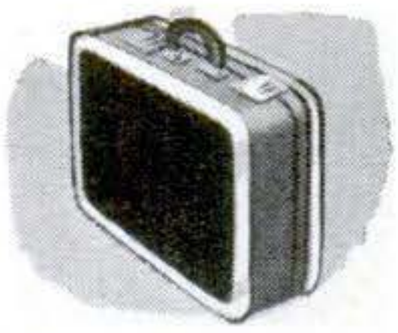

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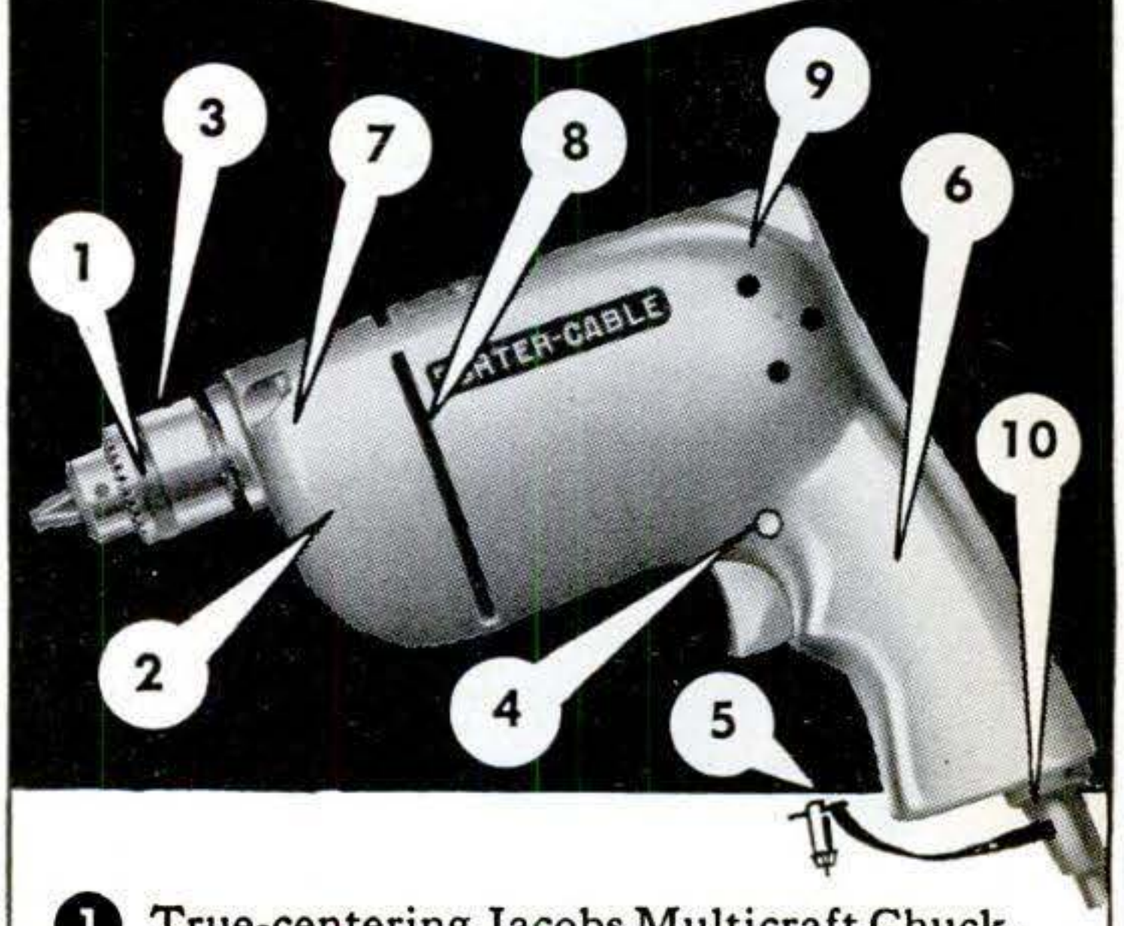

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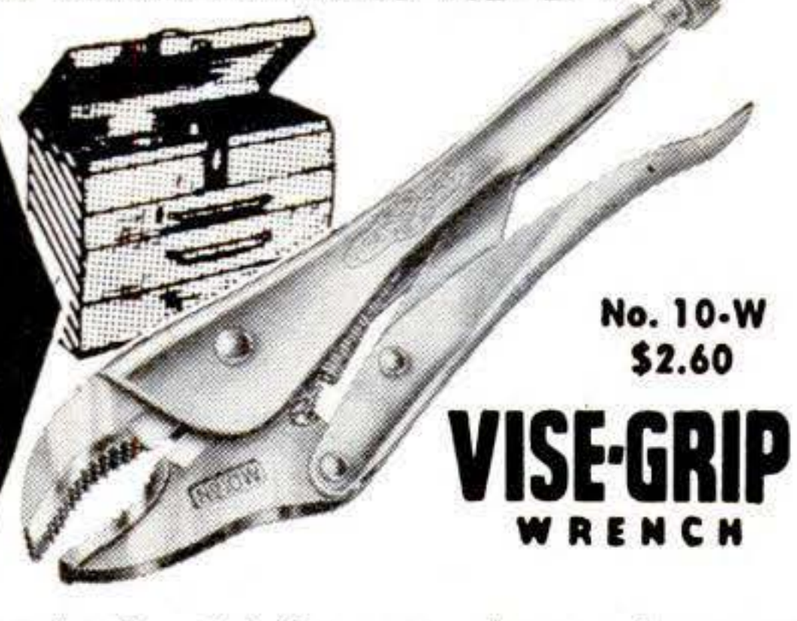

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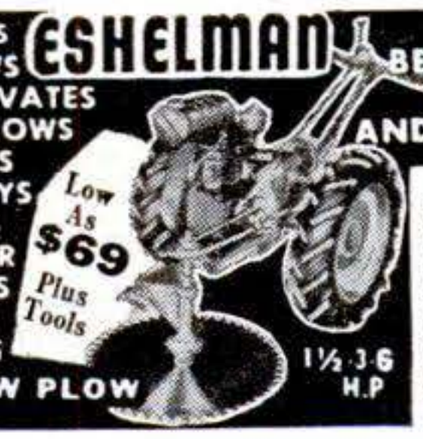

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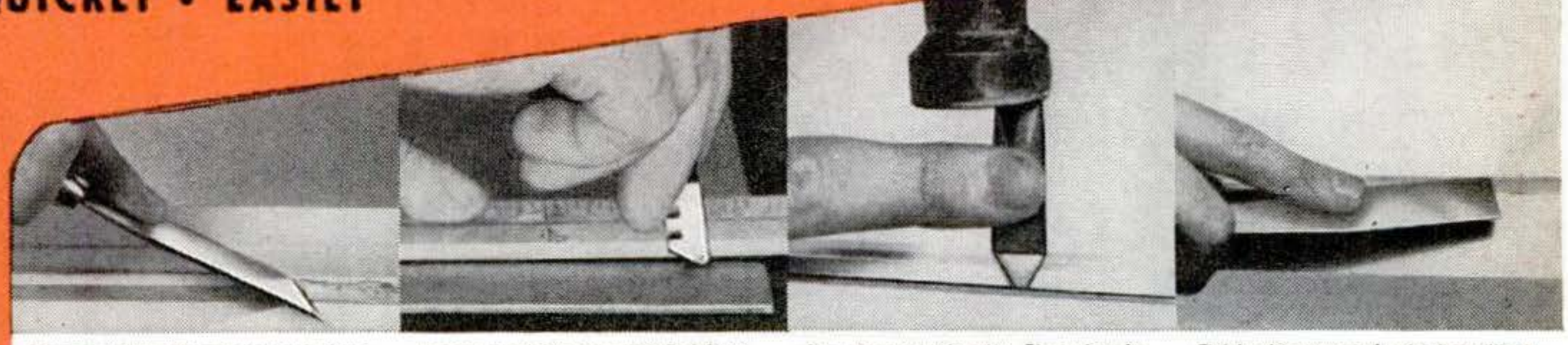

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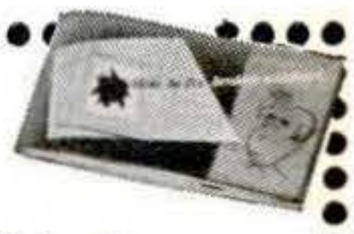

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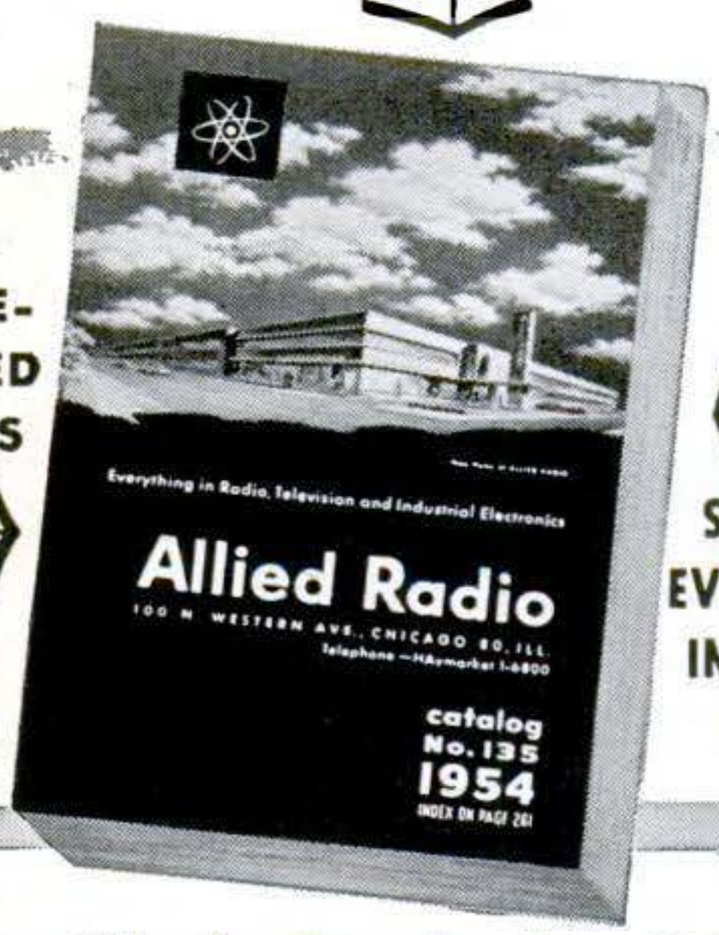

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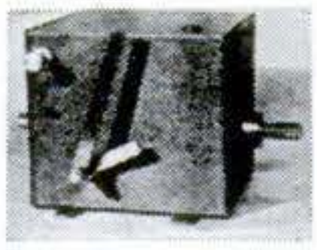

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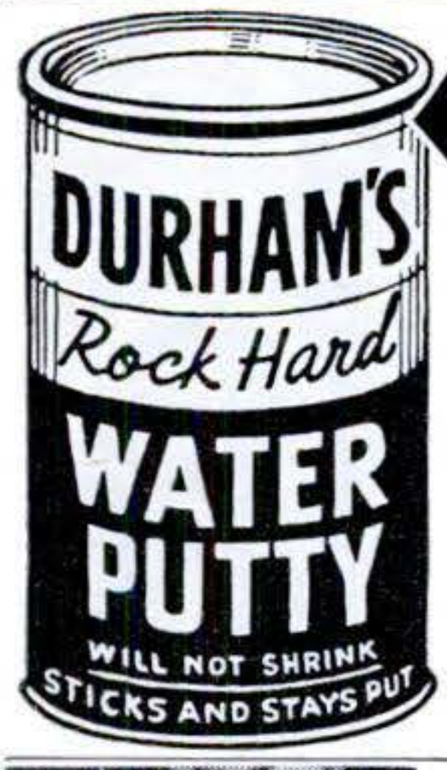

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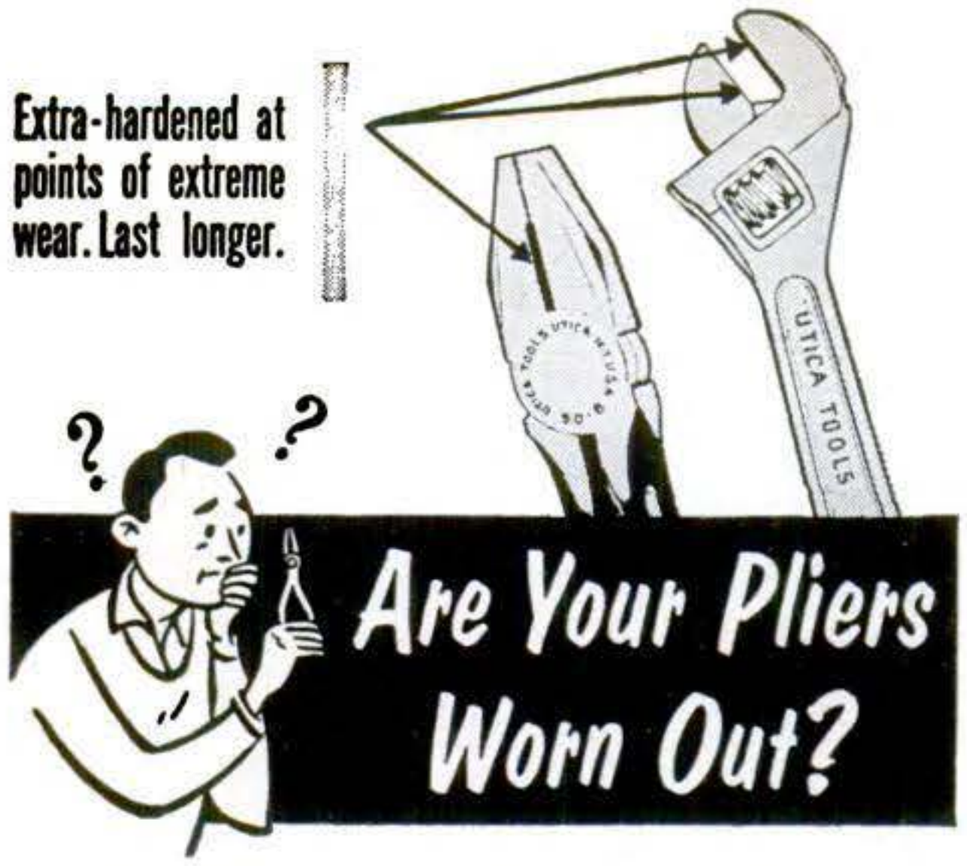

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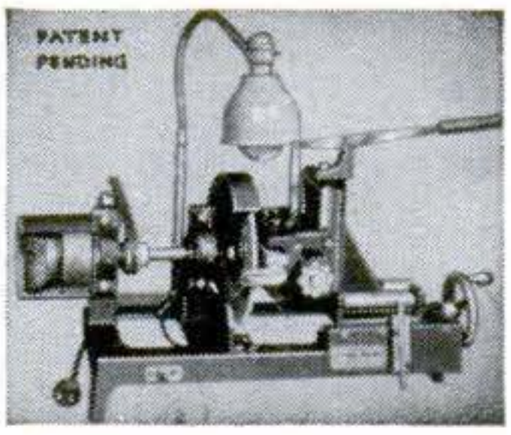

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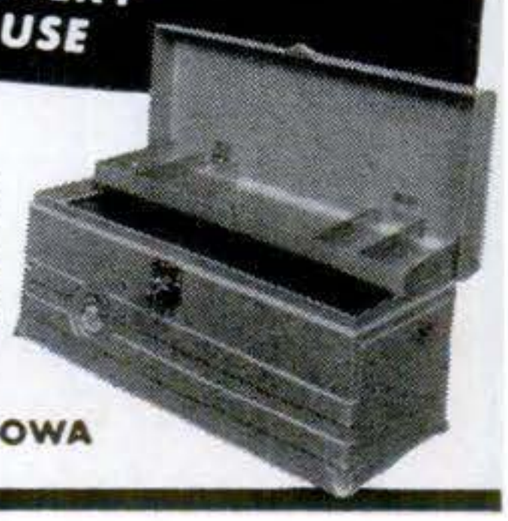

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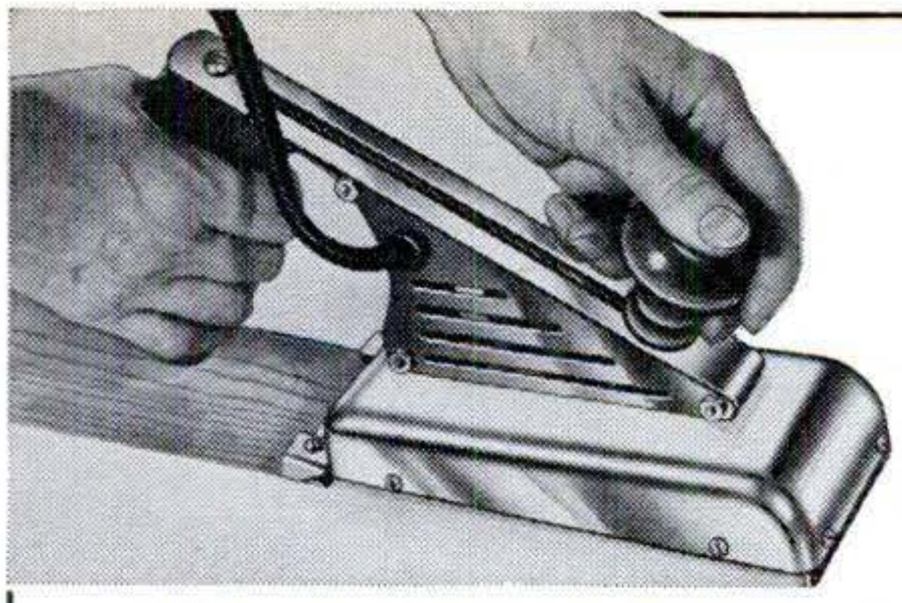

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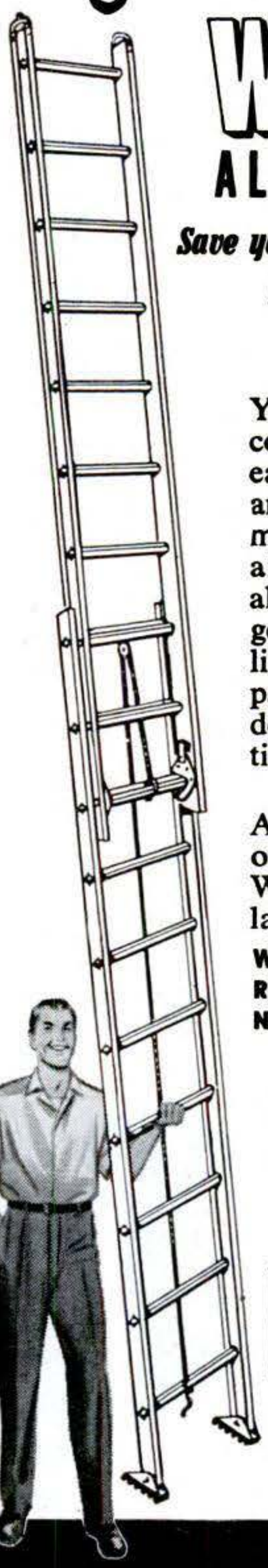

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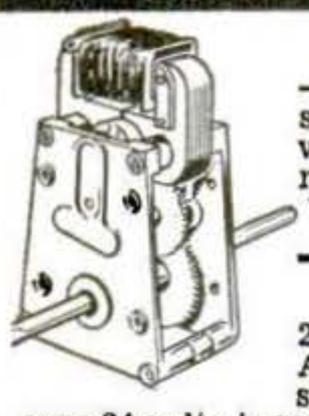

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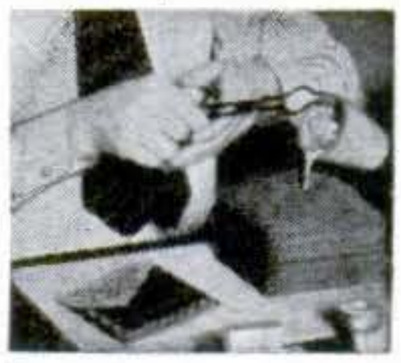

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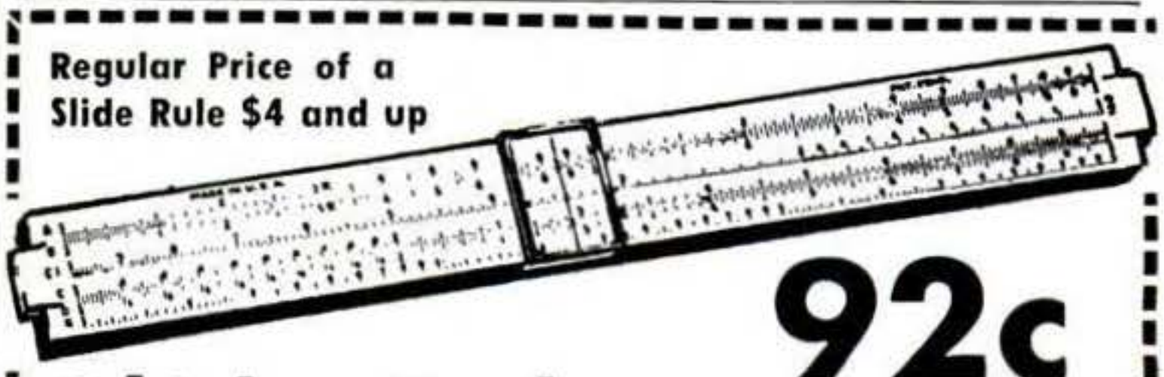

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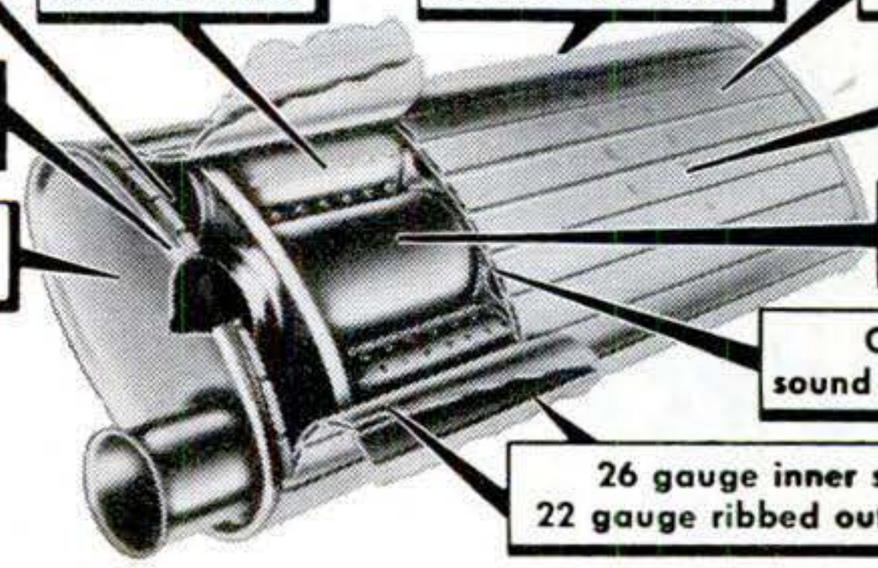

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Yes, quick, sure, INSTANT starts—every time—in any weather. No more stalling! This Stewart-Warner *Electric* Fuel Pump delivers all the gas your engine can use the *second* you turn on the ignition. Operates independently of the engine. Saves your battery. Easy to install on any car or truck.

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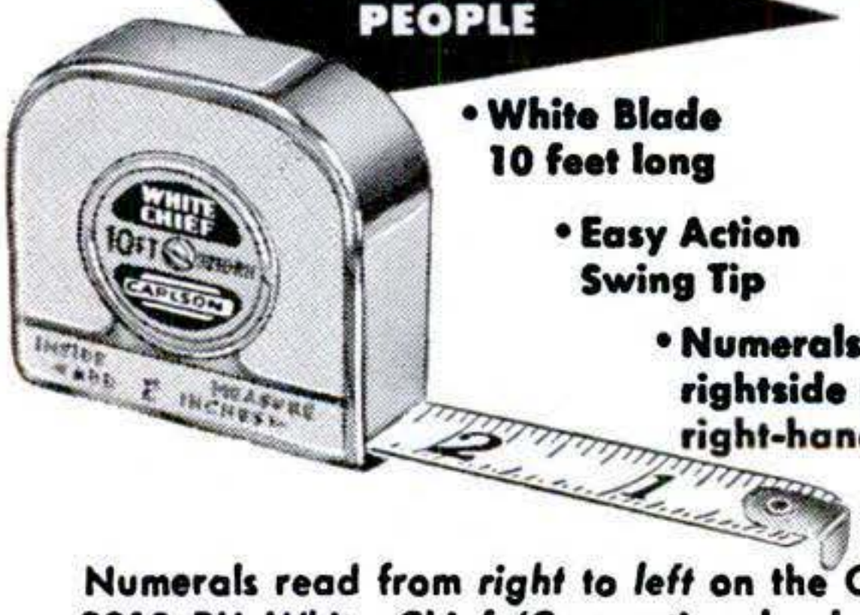

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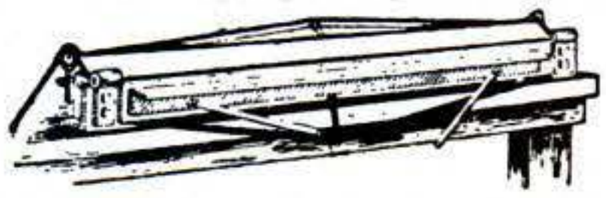

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This **truly** amazing, versatile Syncro Magnetic Jig Saw actually cuts **all** the different materials pictured here **with the same blade** so smoothly sanding is not needed—no "splintering!" NOW—work with **any type** wood—the vast variety of plastics—thin metals like copper, brass, aluminum—even copper tubing, cardboard, tile, linoleum—cut them ALL "satin" smooth without "splintering" with this really remarkable saw. SYNCRO is also so **QUIET** it can be used in apartments—so **PORTABLE** you use on a table, a chair—anywhere—so POWERFUL it's ideal for Dad's workshop. **SAFE FOR CHILDREN**—blade does not pull finger toward it! **Stroke** is adjustable. **Arm** swings to take **any length** cut! Thousands used in schools, homes, hospitals, Cub Dens, Scout Troops. Just plug in this sturdy, precision-made "wonder" tool to any 110-220 Volt A.C. wall outlet—saw for fun or profit! **Remember**—it never needs oiling, has no gears or belts! Its new Reciprocating Electric Motor is BUILT-IN and GUARANTEED against burn-out during your ownership or replaced FREE.

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THE MOST POWERFUL SAW OF ITS KIND

THE BASIC SHOP TOOL

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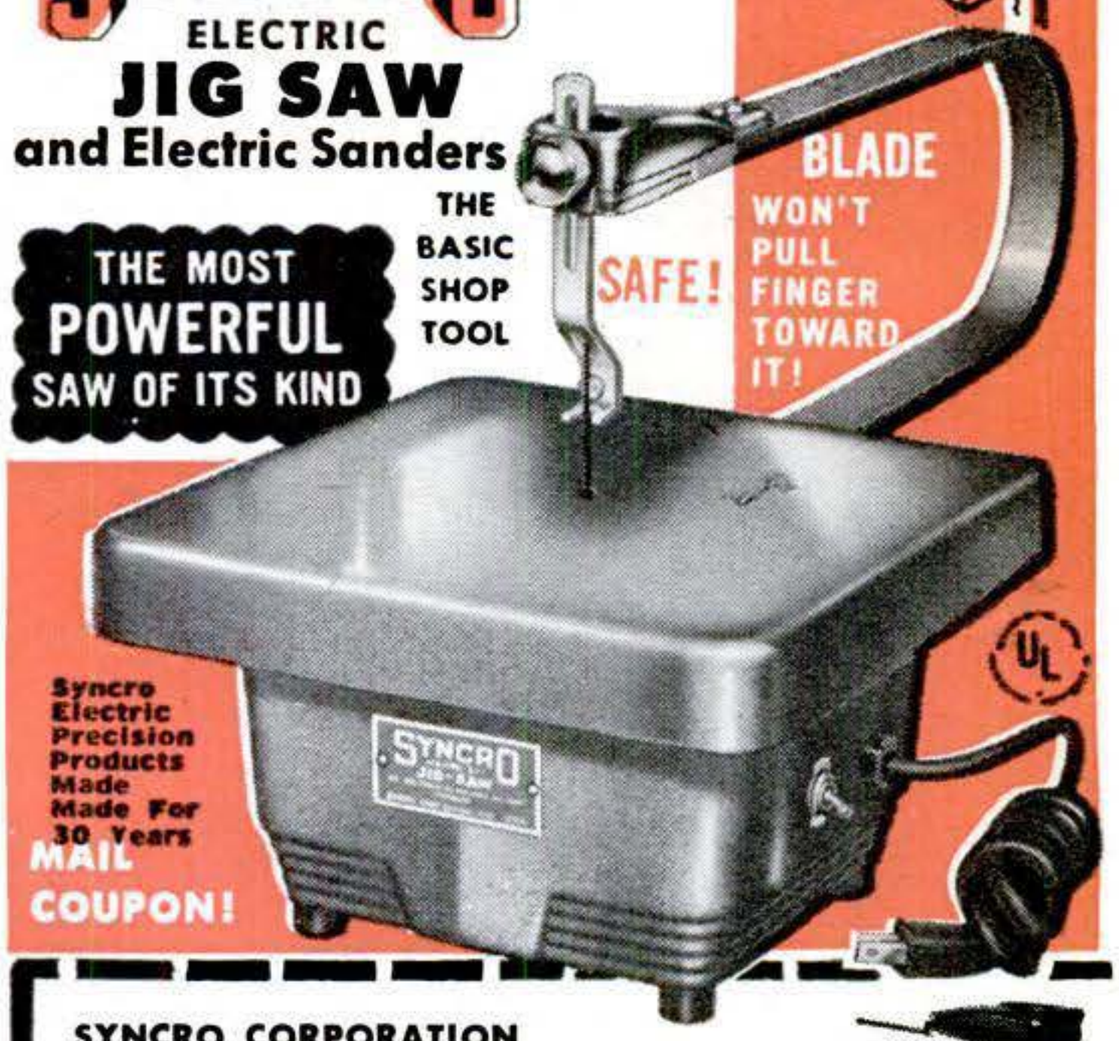

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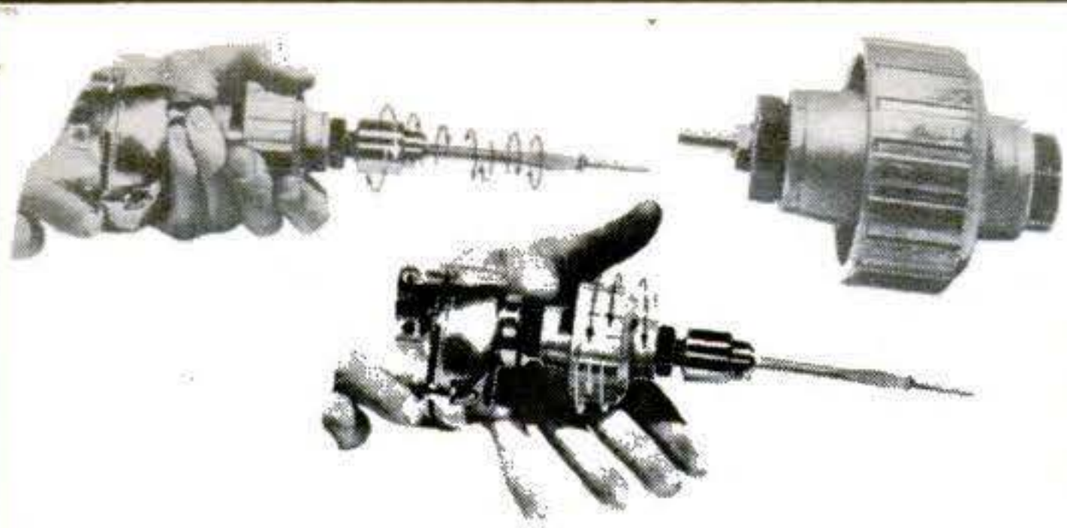

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Convert your 1/4" electric drill to electric screwdriver —drill holes to 1 1/4" in wood, 1/2" in masonry. Planetary gear system gives tremendous torque increase. Adapters furnished to use 1/4" or 1/2" chuck. Instant starting, stopping with hand clutch control. To operate tool grip reducer, release to stop. $9.95 ppd.

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10 TIMES FASTER
with DRIL-O-DRIVER

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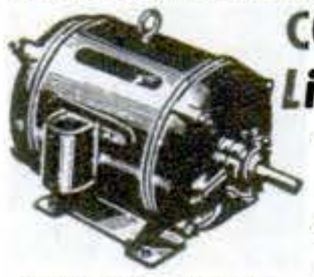

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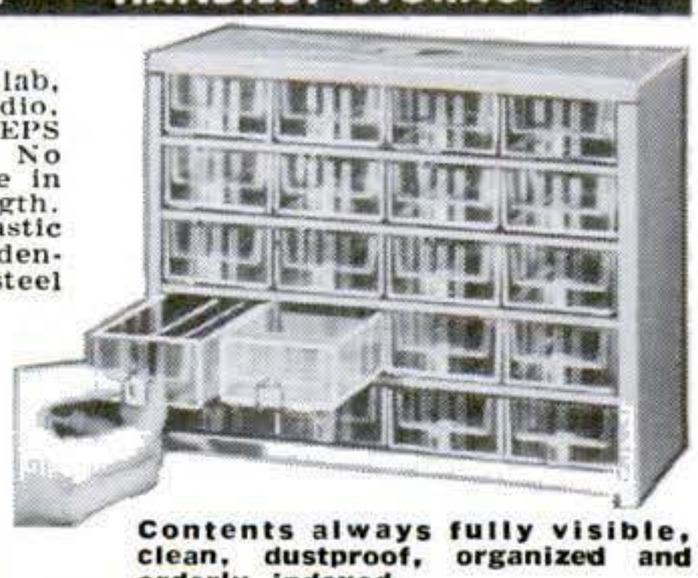

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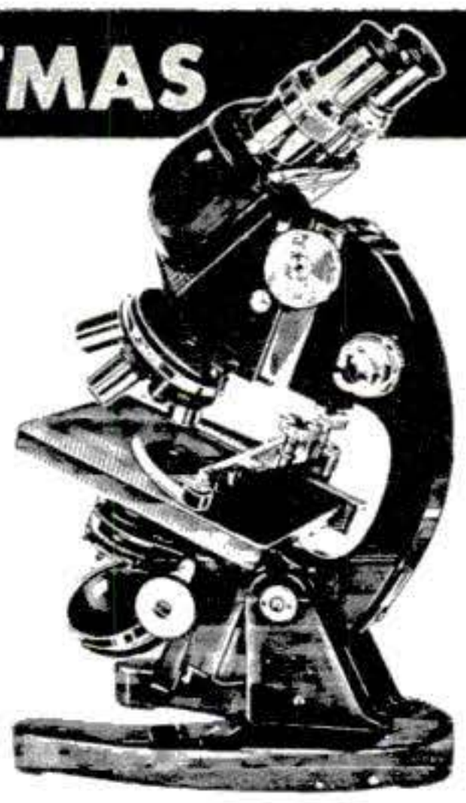

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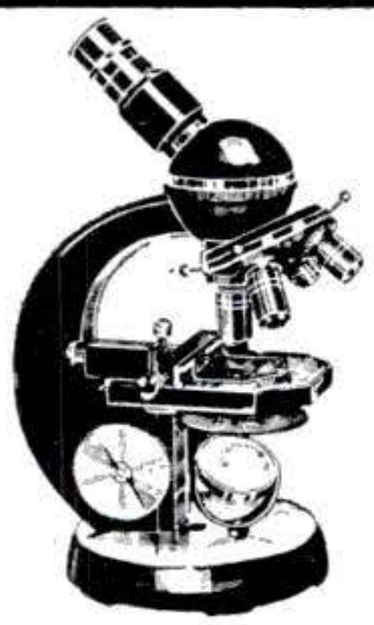

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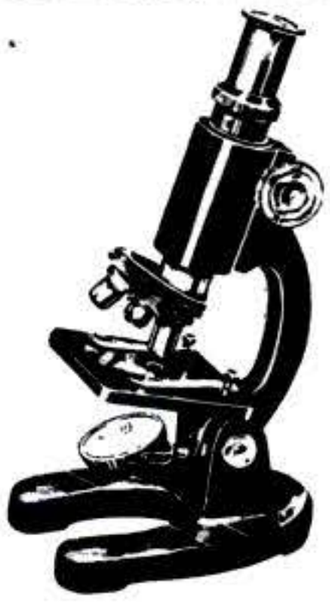

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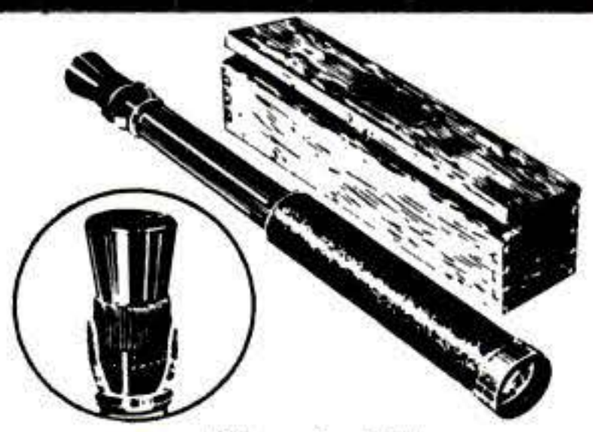

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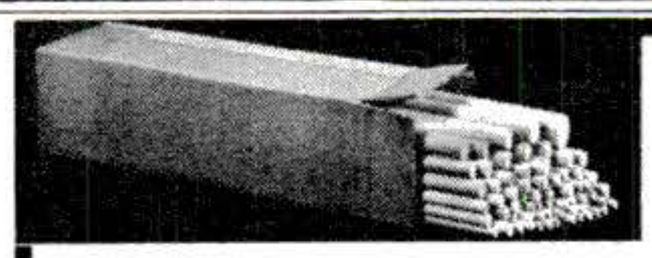

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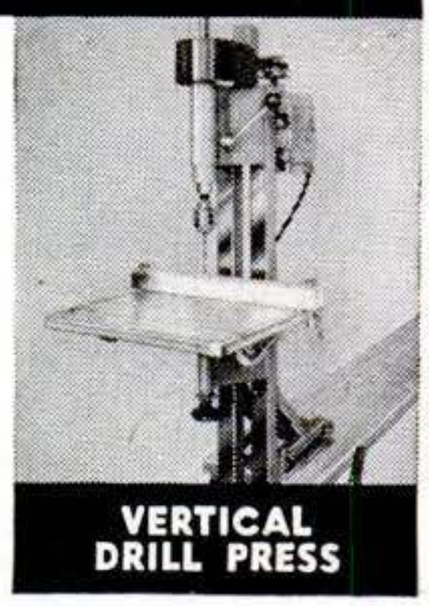

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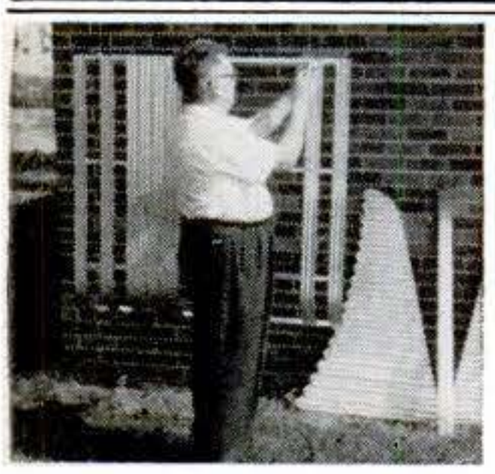

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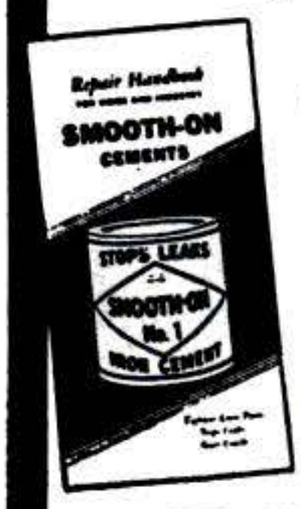

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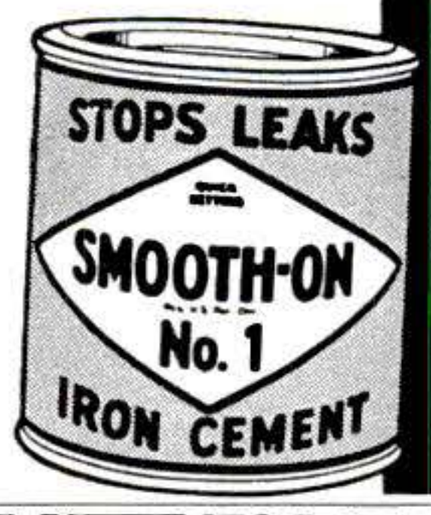

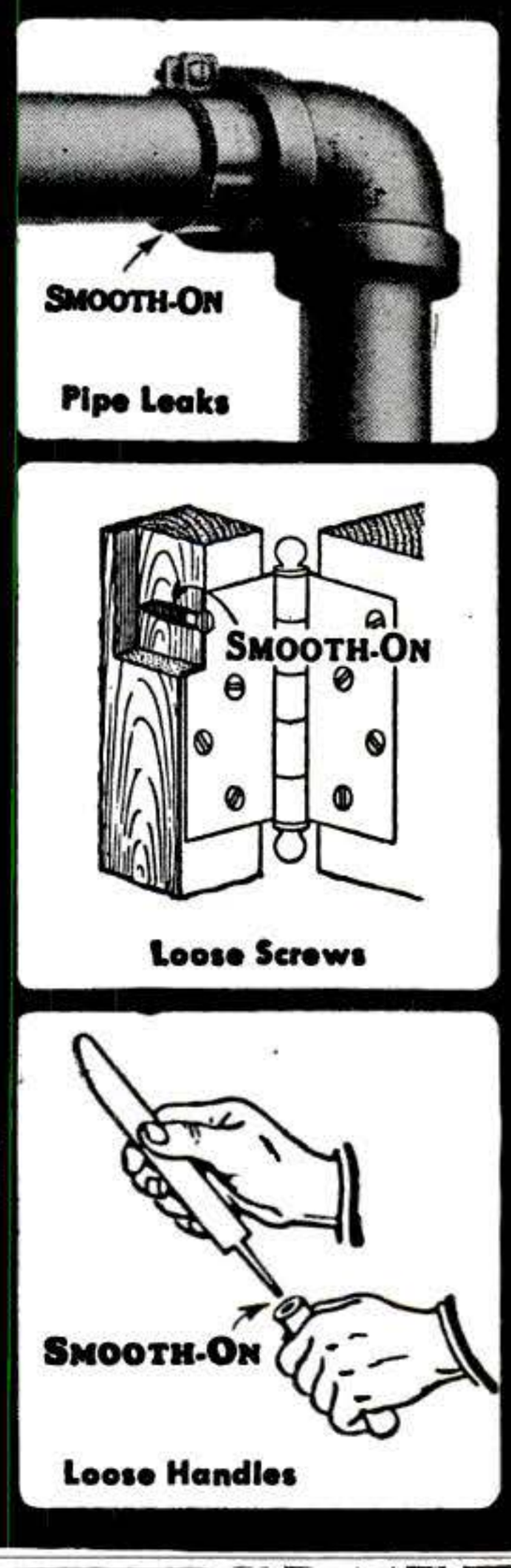

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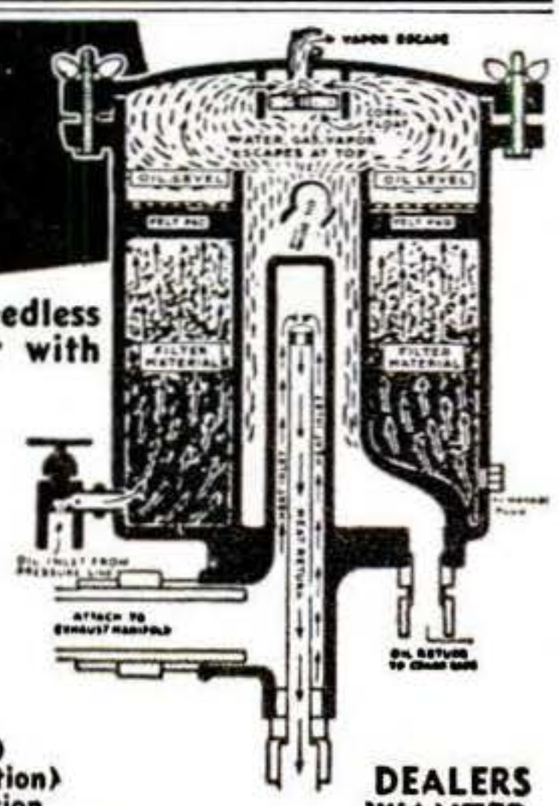

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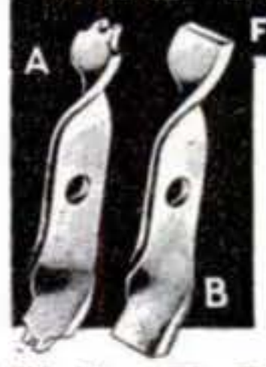

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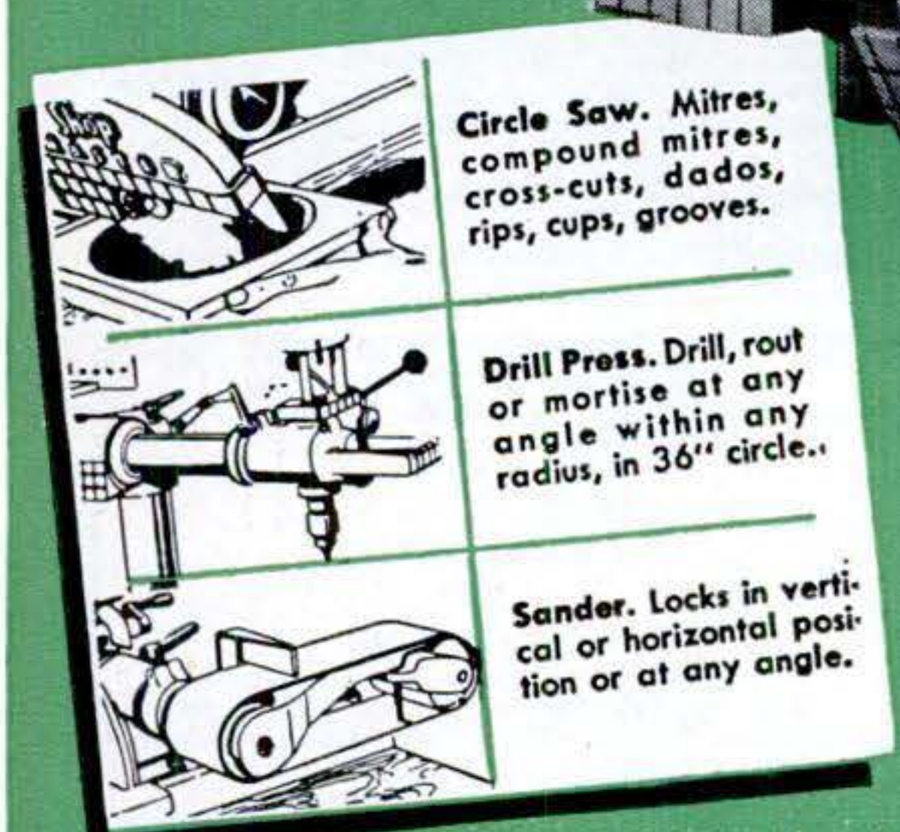

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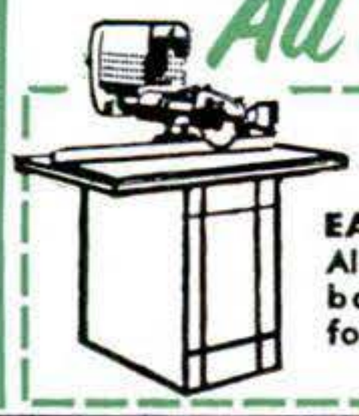

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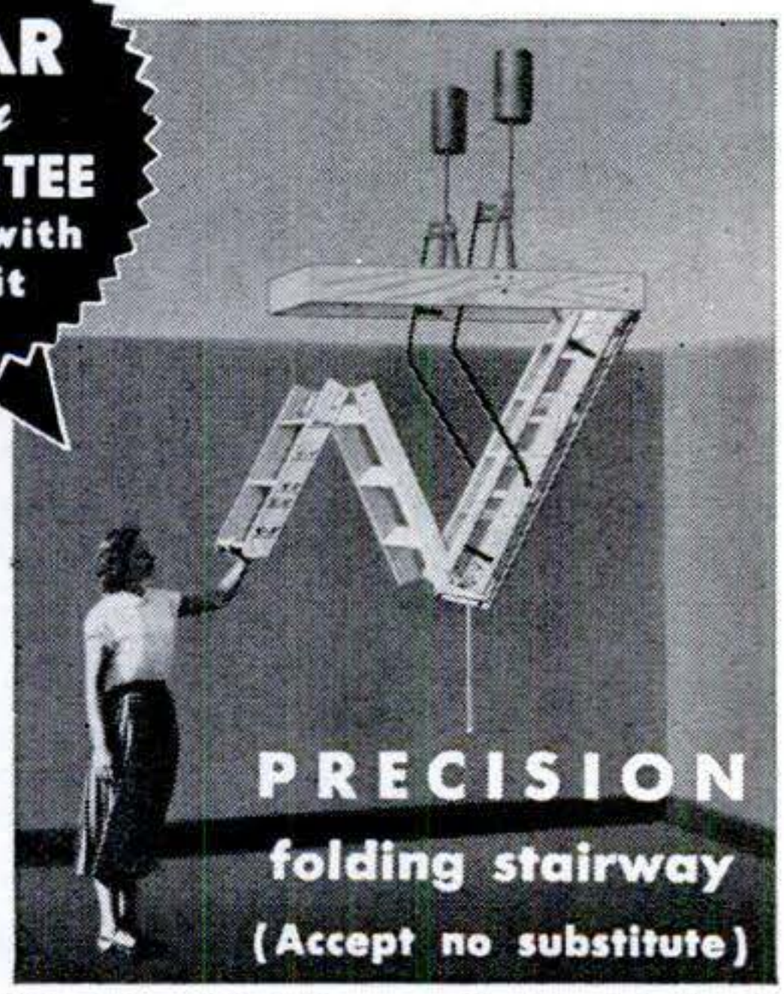

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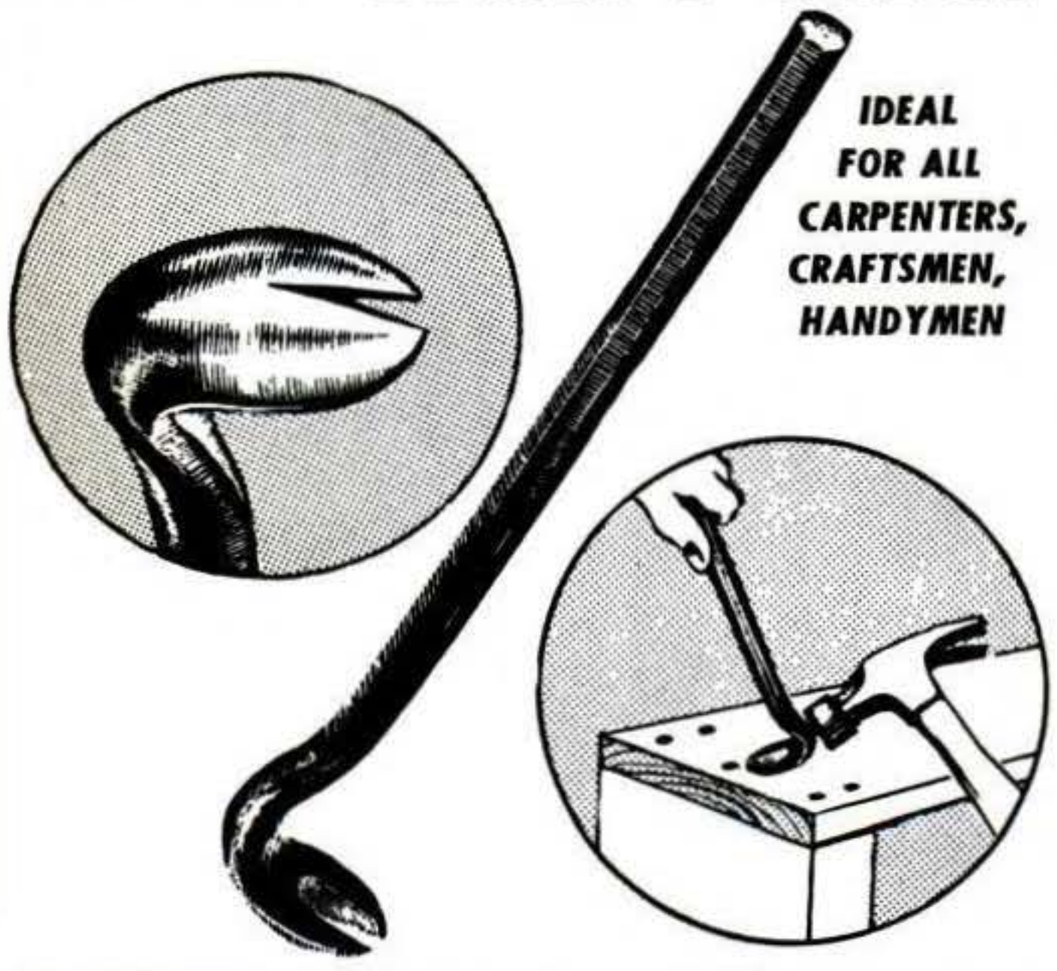

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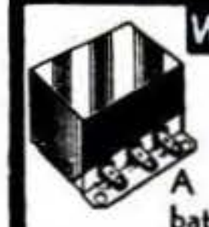

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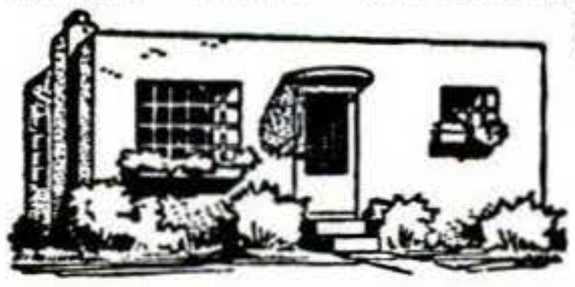

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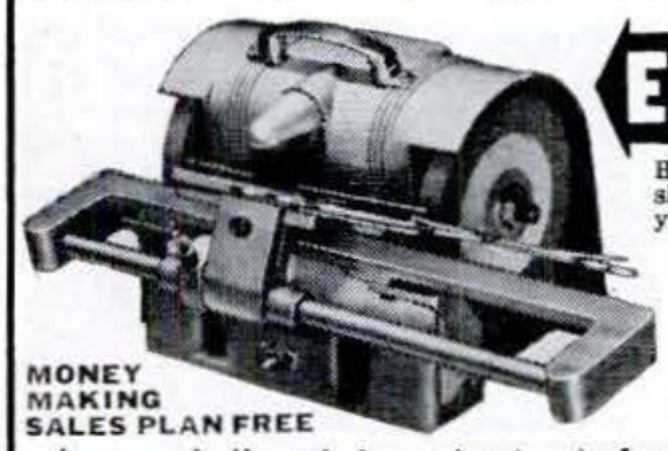

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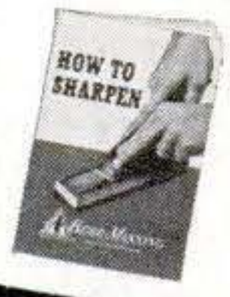

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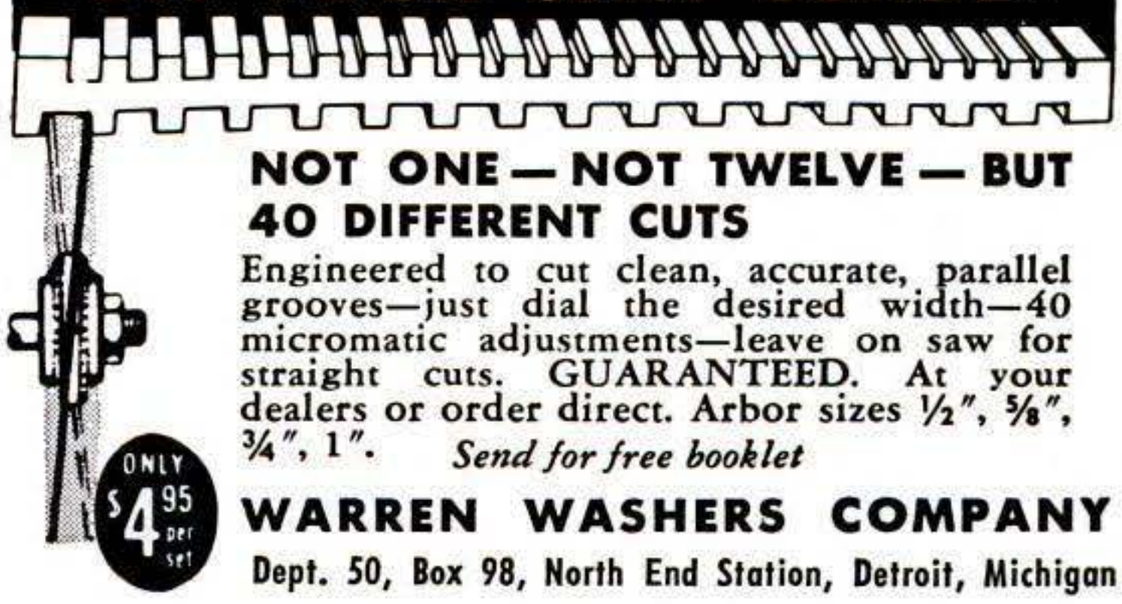

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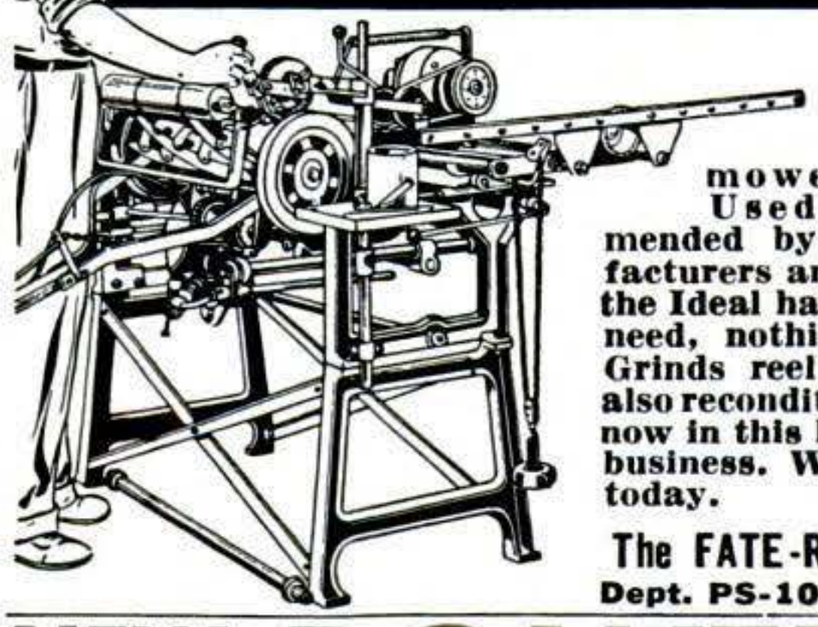

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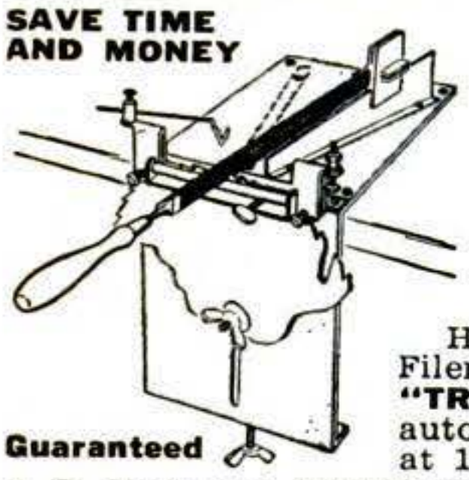

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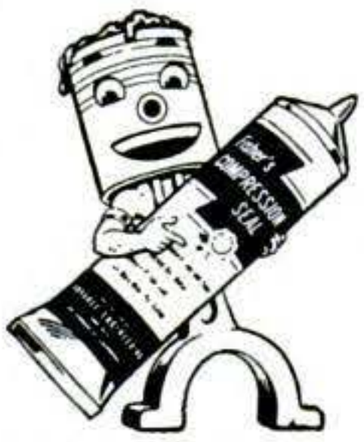

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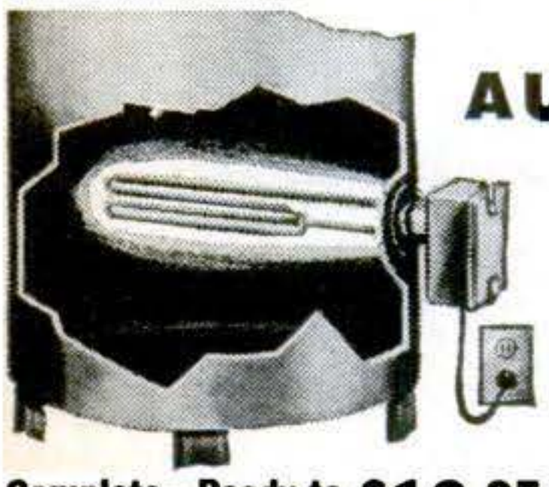

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COLLOID EQUIPMENT Co. Inc. Dept. PS-10, 19 Murray Street NEW YORK 7, N. Y.

BUILD YOUR OWN ARC WELDER OR LIGHT PLANT

D-C GENERATOR

Save $250 to $500

$15.50 used, good cond. Instruc. incl. for Comb. welder & light plant, 200 amps. 28 Volts. 2500 to 4500 R.P.M. Or Brand New Price **$21.50**

PRICE F.O.B. K. C., MO.

CONVERTS TO ARC WELDER 200-250 AMP. OR LIGHT PLANT CAP. LOAD 5000 WATTS

Stock No. 711 D. C. Generator R-1 Jack & Heintz, rated 300 Amp. 30 Volts. Gov't cost $300.00. Instruction for converting to welder or light plant incl..... **$25.50**

CUNO OIL FILTER—BRAND NEW Aircraft type. Filters oil without cartridge replacements. Just turn handle and cartridge is clean. Std. 3/8" inlet & outlet ports. Instructions incl. .. **$4.95** post-paid

Send check or M. Order. Prices f.o.b. KCMo Except when marked pos paid U.S.A

BEAM ROTATOR MOTOR New Applicable for 110V. A.C. or 24V. D.C. Powerful geared motor for TV aerials, Ham FM antennas etc. Approx. 9 R. P. M., free swing Instructions incl. Stock #AJ31

$50.00 value **$7.50**

FIRE EXTINGUISHER 1 Quart size, brass finish Ideal for emergency use handy size. Used, good tested condition. **$3.95** wt. 4 lbs. (add postage)

"BUILD YOUR OWN DIVING LUNG" AN6004-1 Demand OXYGEN REGULATOR Brand New **$8.95** Post paid

GENERAL SALVAGE CO., Dept. 103, 2922 E. 27 St., Kansas City, Mo.

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EDITORS' IMPARTIAL TESTS PROVE:

New Self-Charging Battery Outlasts, Outperforms Others 221%

A few months ago, we started producing a new battery which we frankly believe to be many years ahead of its time. When we announced that this new battery developed 15 amperes more power than other batteries and would automatically bounce back to life again and again after being deliberately and completely discharged, technical editors of leading magazines raised their eyebrows.

When we added that we had named it the *Life*time Battery because of its *life* (meaning exceptional power) and the *time* it would last (3 to 4 times as long as ordinary batteries), and that we guaranteed it for *six years*, these editors were understandably doubtful, to put it mildly. One publisher, in fact, refused to accept advertising for this battery until what he then considered to be our extreme claims were carefully tested.

One of the editors said: "Let us test this battery, any way we see fit. If it does what you claim, it's news our readers will be interested in. If it's no good, our readers will be interested in that, too, and that's the way we'll write the story." We said "go ahead" and they took a standard *Life*time Battery off the production line and went to work.

You may have read the result of the first test in a famous automotive magazine (name on request). Using two well-known batteries (possibly the best-known high-quality batteries in the world) for comparison, they first ran the *Life*time Battery down completely and let it re-charge itself automatically. They repeated this test 43 times the first day, then compared its strength with the other two batteries. Results: the *Life*time Battery was 204% *stronger* than the *strongest* of the other two batteries. They discharged the *Life*time Battery another 20 times, allowing it to re-charge itself automatically each time, and compared all batteries again: the *Life*time Battery was now 213% stronger than one battery, 221% stronger than the other! Next, they put a punishing 300-amp load on the *Life*time Battery; it survived that in good shape. So they repeated the self-recharging test again and finally concluded: "... unprecedented life expectancy ... remarkable recuperative characteristics ... outperformed the others in every respect and by a comfortable margin ... an outstanding value."

The editor of another magazine (name on request) heard about the tests and asked to "give the thing a *real* test, one that would burn up the average battery." We gave him the *same battery* and challenged him to "finish it off." He installed it in his own car and drove the car on the *battery alone*, shifting gears as he would normally, until his "fingers were sore from holding the starter key ... I hate to admit it, but I was outlasted by a battery."

Still another editor wrote: "... definite battery improvement ... greater recuperative power, greater initial output .. obviously high quality."

During independent tests in Alaska and the U.S., the Lifetime Battery was intentionally discharged under sub-freezing conditions, recharged itself automatically & started car at once!

Engineered for Cold Climates

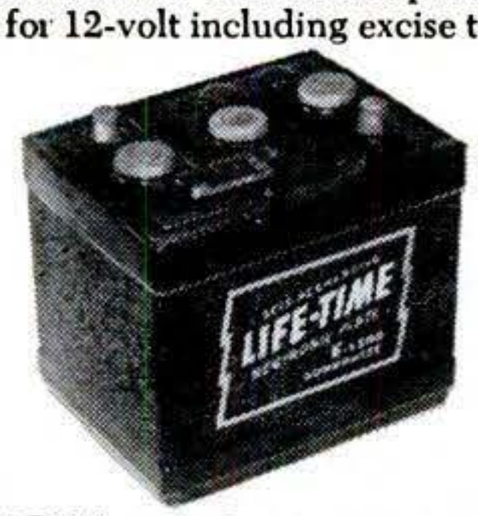
Soon after the *Life*time Battery went into production, we selected a few dealers in northern U.S. and Alaska, shipped them a few batteries and waited to see how the dealers and the public would react. Our Alaska dealer told us that before presenting it to his customers, he was going to give the battery an Arctic test: discharge it completely then freeze it at 30 below zero for 72 hours. Result: the battery had recharged itself and immediately started the car. Immediately we received a telegraphed order from Alaska for $6,043 worth of *Life*time Batteries!

6-Year Guarantee Saves You Up to $107

The average deluxe battery lasts 1.4 years at a typical cost of $25.00, or $107.00 for a 6-year period. This arithmetic is making sense to people who are tired of throwing money away on batteries that just won't hold up. We believe it will make sense to you, too —particularly since the *Life*time Battery you buy now can easily be transferred to your new car whenever you trade in.

12-volt and 6-volt Available

Here's more arithmetic that makes sense. the *Life*time Battery sells in the U.S. at one price for all cars· $29 95 for 6-volt, $34 95 for 12-volt including excise tax.



Supply Limited: Order Today by Mail!

Although plant facilities are being expanded, supply is still limited. If your dealer can't supply you, order direct by mail from the factory; we pay freight.

CONTINENTAL MANUFACTURING CORPORATION (Marketing Division, Consolidated Engineers)
Dept. BS-10, Washington Boulevard at Motor Avenue, Culver City, California

Dealers NOW BEING APPOINTED TO HANDLE DEMAND

Dealerships are now being awarded to take care of demand generated by $1,000,000 advertising campaign plus articles in national magazines. Write today for full information, including reprints of editors' tests and case histories from present dealers.

Continental Manufacturing Corporation, Dept. BS-10
Washington Blvd. at Motor Ave., Culver City, Calif.

Please ship *Life*time Battery at once:
- ☐ 6-volt ($29.95 including tax)
- ☐ 12-volt ($34.95 including tax)

for_____
(make, model, year of car)

- ☐ I enclose cash, check, or money order: you pay shipping cost.
- ☐ I enclose $5 deposit, will pay balance & shipping costs C.O.D.

Name_____
Address_____
City_____ Zone____ State_____

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[Continued from page 102]

changed, the property owner can be assured of a supply that is at least as large as the capacity of his pump. If, on the other hand, pumping depresses the water level, he may as well be prepared for domestic shortages.

All dowsers, and even the many non-dowsing well drillers, know this. Most of them are so familiar with the country in which they habitually operate that they can forecast the performance of any well they drill more accurately than a geologist foreign to the locality.

But times are changing. The search for water is going through the same evolutionary cycle as the search for oil, where hunches and dumb luck can no longer be counted on to pay off.

Like my engineer friend Schlecht, the company that needs a dependable water supply is not likely to bet on dowsing. Instead, it will seek the advice of the experts—the geologists, the hydrologists, and the geophysicists.

Oil-Hunting Techniques Used

New techniques are appearing as these scientific water hunters borrow from the toolbox of the oil seekers. One new method, for example, involves studies of the electrical conductivity of the earth. Dry rocks are in general nonconductors of electricity. Water-saturated rocks—aquifers—do conduct electricity and their conductivity goes up with the amount of water they carry.

This conductivity—or the earth's resistance, which is in inverse ratio to the conductivity—can be measured by putting two electrodes a few feet into the earth a short distance apart and generating a current between them. Various portions of the current will travel through different layers of the subsurface rocks. Upon their arrival at the second station where the receiving instruments are, the conductivity or resistance of the rock through which they have passed can be measured, giving clues as to the water content.

There is one catch to this method, however. Increased conductivity can result from a high metallic content in the rock. So it may turn out that when you think you've found water-carrying rock you've really discovered a vein of copper.

Another oil-prospecting device that can be adapted to the search for water is the seismograph. Just as measuring shock waves at a distance from an explosion can help indicate whether oil-bearing rocks are below, shock waves can be used to locate water-bearing layers. But, this is an expensive method.

UHF Comes into Play

A third method, still unperfected, involves use of ultrahigh-frequency sound waves. It is hoped that these waves can be transmitted through the earth and bounced off layers of underground rock to reveal underlying structure.

Do such new tools and professional scorn spell the doom of dowsing? I don't believe so. The rugged uplands of New England and the Appalachians, the glaciated terrane of the North Woods, the isolated valleys and slopes of the Rockies and the Great Basin, will never support dense populations. Water in small quantities for domestic use will always be in demand, and because of the character of the rocks it will not be easy to find. Here is where dowsers will survive.

Is their success entirely the result of long observation and experience? I believe that this is a question that requires more serious investigation than the earth scientists have made to date. Although I haven't held a forked stick in my hands since 1926, I can't forget that that stick *did* bend down of its own accord in that upland 14 miles from Arecibo. I don't know why. I wish I did. END

Three Kinds of People

PEOPLE can be placed into three classes: the few who make things happen; the many who watch things happen; and the overwhelming majority who have no idea what has happened. —*White Plains Reporter-Dispatch.*

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SAVE up to 85%-DIRECT from FACTORY

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM).

8" Fan, wt. 5 lb. $6.85
9" Fan, wt. 6 lb. $7.85
10" Fan, wt. 7 lb. $8.85
12" Fan, wt. 8 lb. $9.85

HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E) $11.95
12" Fan, wt. 10 lbs. (Item 10D) $12.95

FLEXIBLE SHAFT A precision built, heavy duty tool with amazing flexibility. Replaces a dozen individual tools—drills, buffs, grinds, sands, saws—handles jobs in impossible places. Fits any 5/8" shaft on lathe, drill press, grinder motor, spare gas or electric motors, etc. Heavy duty 3/8" piano wire core encased in tough rubber housing. Handle and arbor have rugged industrial type precision ball bearings for years of service. Arbor takes all 1/2" bore wire wheels, grindstones, etc. 1/2"—20 standard threads. Use with any 1/4, 1/3 or 1/2 hp. motor. (Item 240). Wt. 10 lbs.
Reg. $29.95 ..... **$15.95**

EXTENSION CORD

Heavy duty, made of Buna rubber insulated #14, 2 conductor stranded wire encased in a treated braid jacket; tough, flexible and resists oil, grease or water. Use indoors or out. Complete with heavy rubber plug and outlet. (Item 16) 40 ft. 2 1/2 lbs. **$1.99**
Combination 2-40 ft. and 1-20 ft. (total 100 ft.) ..... (Item 16c) $4.95
100 ft. length (1 piece) ... (Item 16p) $4.85

NEOPRENE EXTENSION CORD

#16, 2 conductor stranded wire, extremely flexible, ideal for hedge trimmers, lawn mowers, power tools, etc. Tough and rugged, withstands any abuse. Complete with rubber plug and outlet. 40 ft. (Item 17a) wt. 2 1/2 lbs. Regularly $4.95. SPECIAL $2.49
Combination 2-40 ft. and 1-20 ft. (total 100 ft. (Item 17n) $5.95
100 ft. length (1 piece) .... (Item 17t) $5.85
Wire only. No fittings. 100 ft. (Item 17r) $5.00

NEOPRENE CABLE #14-2 (Item 185) Heavy duty, very flexible. 20 year quality. Wt. 9 lbs. 100 ft. Complete with rubber plug and outlet. *A terrific buy at only* $8.95

NO. 12-2 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 199) wt. 8 lbs. $6.95. 100 ft. (Item 200) $12.95

HEAVY DUTY D-C ARC WELDER

with mounting flange (Item 38)

Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to 3/4" plate using 1/4" rods. Built-in air cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and triple V belt or flat pulley. You can pay more, but you can't buy a better welder. Wt. 110 lbs. $400 value at **$99.75**

DUAL CONTROL MODEL same as above but with built-in dual rheostat for low heat soldering, brazing, welding. Spec. **$119.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at .. **$10.50**

Write for prices on A.C. Arc Welders

MASTER AIR COMPRESSOR

Tank Tested up to 500 lbs. per sq. in.

(Item 209) High pressure type for large volume of air for heavy duty service. For paint spraying, inflating truck and auto tires, greasing and the hundreds of other jobs done by compressed air. Piston type. 2" bore compressor with built-in air filter. Master built with hi-strength alloys and precision bearings. Stainless steel tank, 12"x24", 2100 cu. in. cap. Safe up to 500 lb. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lb.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Low factory prices. With 1/3 hp., 110 v. A.C. motor. (Reg. $175.00)
(Item 209p) **$109.50**
With 1/2 hp. motor. Reg. $199.50 (Item 209Ap) **$129.50**
With 2 hp. Briggs Gas Engine. Reg. $199.50 (Item 209Bp) **$119.50**

MASTER GARDENER SELF-PROPELLED

It's a snow-blower — It's a rotary mower
It's a power sickle — It's a rotary tiller
It's a cultivator — It's a plow

NO PUSHING

Tractor shown with Snow Blow Attachment

(Item 206)

Where can you get a power tool that does so many jobs? Works for you the year 'round. Does terrific job of cleaning snow from walks, drives, etc. without backbreaking work. Also prepares deep mellow seed beds, cuts weeds, lawns, etc. The Master Gardener performs better — does more than tractors costing twice as much. Converts in minutes to Tiller, Power Sickle, etc. Basic self-propelled 2 hp tractor. Briggs or Clinton engine. **$119.50**

Snow Blow ... $39.50 — Rotary Tiller . $42.50
Cultivator .... $8.75 — Disc Harrow .. $15.75
Furrowing Tool $8.75 — Plow $15.00
Rotary Lawn Mower $42.50
Sickle Bar Mower $42.50
Lawn Mower Hitch $4.50

Freight prepaid to most areas. Easy payment plan available.

SAVE $125 on LIGHT PLANT

★ LITTLE GIANT ★

FREIGHT FREE! in OCT.

Imagine—65 compact pounds of portable power that goes with you anywhere—easier to carry than an outboard motor. Provides plenty of current for lights, portable radios, 1/4" drills, small power saws, electric shavers, etc. Perfect for hunters, campers, contractors' service trucks, wreckers, etc. 350 Watts, 115v. DC. Ruggedly constructed with 1 1/2 HP Briggs Engine. List price $224.75. Special this month only (Item 273) at the terrific factory price (freight free) of only **$99.75**

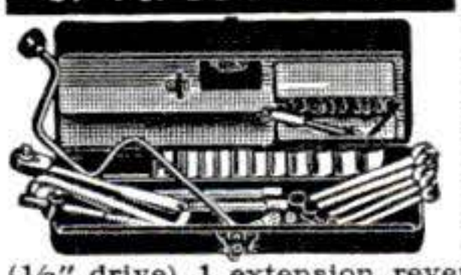
JET FLOW BLOWER

Tremendous air movement (1700 CFM) and quiet operation make this double inlet 10" turbine blower unbeatable for heating, cooling, drying and air conditioning. Ideal for attic or barn ventilation, converting gravity heating to forced air; spray booth exhausts, etc. Operates with any 1/4, 1/3 or 1/2 HP motor. Oversized, long life bearings. Includes variable speed motor pulley and belt. Dimensions 19" hi x 8" x 16 1/2". Outlet opening 13 x 11 3/8". Wt. 45 lbs. Item 245. Reg. $54.50.
Factory Special **$27.50**
HEAVY DUTY 1/4 HP motor for above $16.95

NEW MOTOR BIKE

Our Commando Motor Bike is trouble-free—carries amazing 5 yr. guarantee. Goes up to 150 miles per gal. on all roads. Speed to 40 mph. Easy automatic pedal or pull starting and smooth automatic transmission. Accelerates quickly. Complete motor and kit ready to attach to your bike in one hour. Get FREE folder. Factory Price **$125.00**
Complete bike and motor $199.50

37 Pc. SOCKET SET



Highest quality, guaranteed non-breakable sockets made by Husky. Beautifully matched chrome alloy, absolutely the best. Complete range of 17 sockets from 1/4" thru 1/2" (1/4" drive) and 7/16" thru 1-1/16" (1/2" drive), 1 extension, reversible 1/2" ratchet, adapter bit, sliding "T" handle, "L" handle, 1/2" speeder, 5 pc. alloy combination wrench set, 8 pc. Allen wrench set, and a big doghouse tool box. We challenge anyone to match this value. Easily worth $41.95. Wt. 14 lb. (Item 59) **$16.95**

44 Pc. SOCKET SET

(Item 596) Same unconditionally guaranteed, non-breakable sockets as above—but with added sizes. Complete range of 21 sockets from 1/4" thru 7/16" (1/4" drive) and 7/16" thru 1-1/16" (1/2" drive). Two extensions, reversible 1/2" ratchet, 3 drift punches, sliding "T" head, all angle coupling, 1/2" speeder, 1/4" breakover, 5 pc. high chrome alloy combination wrench set and 8 pc. offset wrench set in big doghouse tool box with ample room for other tools. Reg. $49.50.
Wt. 16 lb. **$21.95**

52 Pc. SOCKET SET

(Item 205) Contains a complete set of sockets in 1/2" drive, 3/8" drive and 1/4" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. Beautiful matched chromed thin wall alloy sockets in a sturdy handsome steel tool box. Wt. 17 lbs. List Price $62.90. Factory Special **$27.95**

DIESEL LIGHT PLANT

(Item 1660) Diesel Master—11-12 kw. 115/230 v. AC single or 3 phase. 1800 rpm direct connected. Electric Self-starting. Engineered for permanent power where continuous low-cost, heavy duty service is important. Wt. 1350 lb. Reg. list $3650.00.
Factory Price **$1895.00**

10-11 kw. **GAS DRIVEN PLANT.** 115-230 v. 60 cyc. AC, single or 3 phase, powered by 4 cylinder Wisconsin air cooled engine. Belt driven. Constructed similarly to Hi-Line 6 KW shown below but much larger. (Item 217) (with crank start)
Wt. 900 lb. Factory price **$1075.00**
Same plant with elec. self-starter .. $1145.00

PORTABLE LIGHT PLANTS

(Item 24)

PUSH BUTTON START

AC Plant 600-700 Watts —115 v.-60 cyc. Powered by a rugged 2 hp. easy-starting Briggs gas engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 w. Ideal for Civil Defense, Fire Depts., trailers and camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Item 24. Wt. 75 lbs. Be prepared if war or storms knock out power lines. Reg. $275.00 value .. **$143.50**

700-800 Watt Plant (Item 44) same as above but larger engine **$169.95**

1000-1200 Watt Plant (Item 45) same as Item 24 but with larger generator and engine—50% greater output .. **$199.50**

1500-1700 Watt Plant (Item 20)—Similar to Item 24, but has three times more capacity. Wt. 173 lb. Factory price **$279.50**

MASTER-LITE 2500 Watt PLANT

(Item 21)

110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 5.10 Briggs engine, complete with all accessories. Includes control box, voltmeter and handy plug-in power receptacle. Ideal for permanent or stand-by service. Wt. 225 lb. Regular price $645.00. Factory price .. **$329.50**

3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. $760. Factory Price $379.50

GIANT 2000-2500 Watt Plant—110/120 v. AC, belt driven so that engine may easily be utilized for other purposes. Powered by a rope start. 6 HP engine. Wt. 210 lb. Regular list price $585.00.
Factory price (Item 31) **$299.50**
Generator only and control box (Item 31a) $169.50

HI-LINE 6000 WATT PLANT

(Item 162)

(Item 162) **Push Button Start**, 115-230 v. 60 cycle AC. A brute of a power plant with a rugged 14 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Provides both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995.00. With self starter. Factory Spec. ... **$645.00**

Same plant but with **Crank Start** (Item 166) .. **$585.00**

Generator and control box only, belt driven. Use your own engine or tractor. Wt. 240 lbs. (Item 163) Factory price **$345.00**

We make fully automatic controls to operate any of above light plants. Write for details. We make all sizes up to 25,000 Watts—Write.

1 1/2 TON MASTER HANDEE DUMP

Here at last is an all-purpose 1 1/2 ton dump trailer. Can be used anywhere, inside or out for hauling sand, gravel, dirt, coal, grain, trash, industrial scrap, etc. Unloads, tilts, dumps to either side with one pull of the handle—yet trailer cannot tip. Ruggedly built, girder type frame equipped with pneumatic 4:00x12x6 ply tires and Timken roller bearings. Easily towed by any car, truck, jeep, tractor, etc.—has universal ball hitch front and rear—several "Handee-Dumps" are instantly coupled together. Capacity 1 1/2 ton—3/4 yd., overall length 104", Width 40", wheel base 84". (Item 237) Wt. 460 lb.
Factory Spec. **$350.00**
DUAL TIRE (8 wheel) model, similar to above, 510 lb. **$450.00**

Send check or M.O. Prices f.o.b. Factory. 10 day Money back guarantee. Send 10c for BIG Catalog.

MASTER MECHANIC MFG. CO., DEPT. 39D **Burlington, Wis.**

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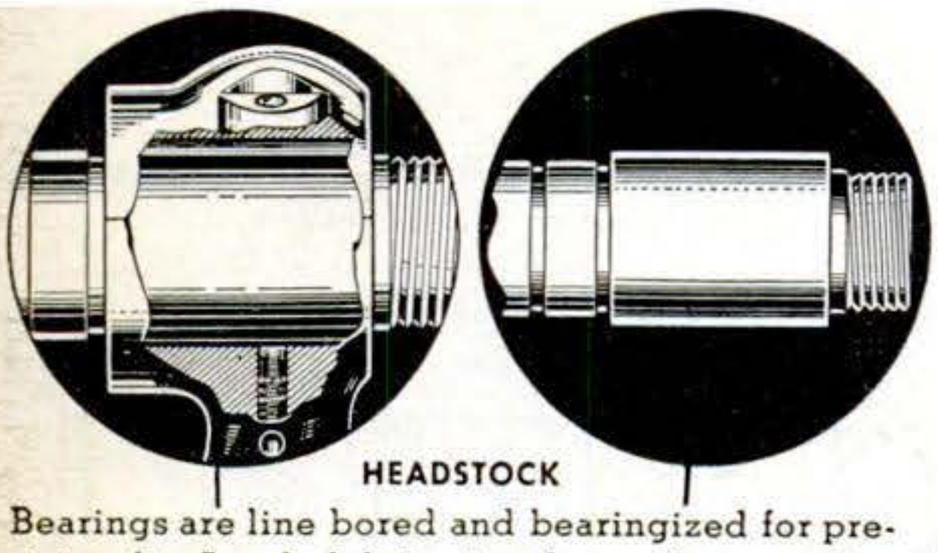
SOUTH BEND 9" LATHES



HEADSTOCK

Bearings are line bored and bearingized for precision fit. Ample lubrication from oil reservoirs. Spindle is carburized, hardened, and ground; with bearing surfaces super-finished to .000005" rms.

BELT RELEASE

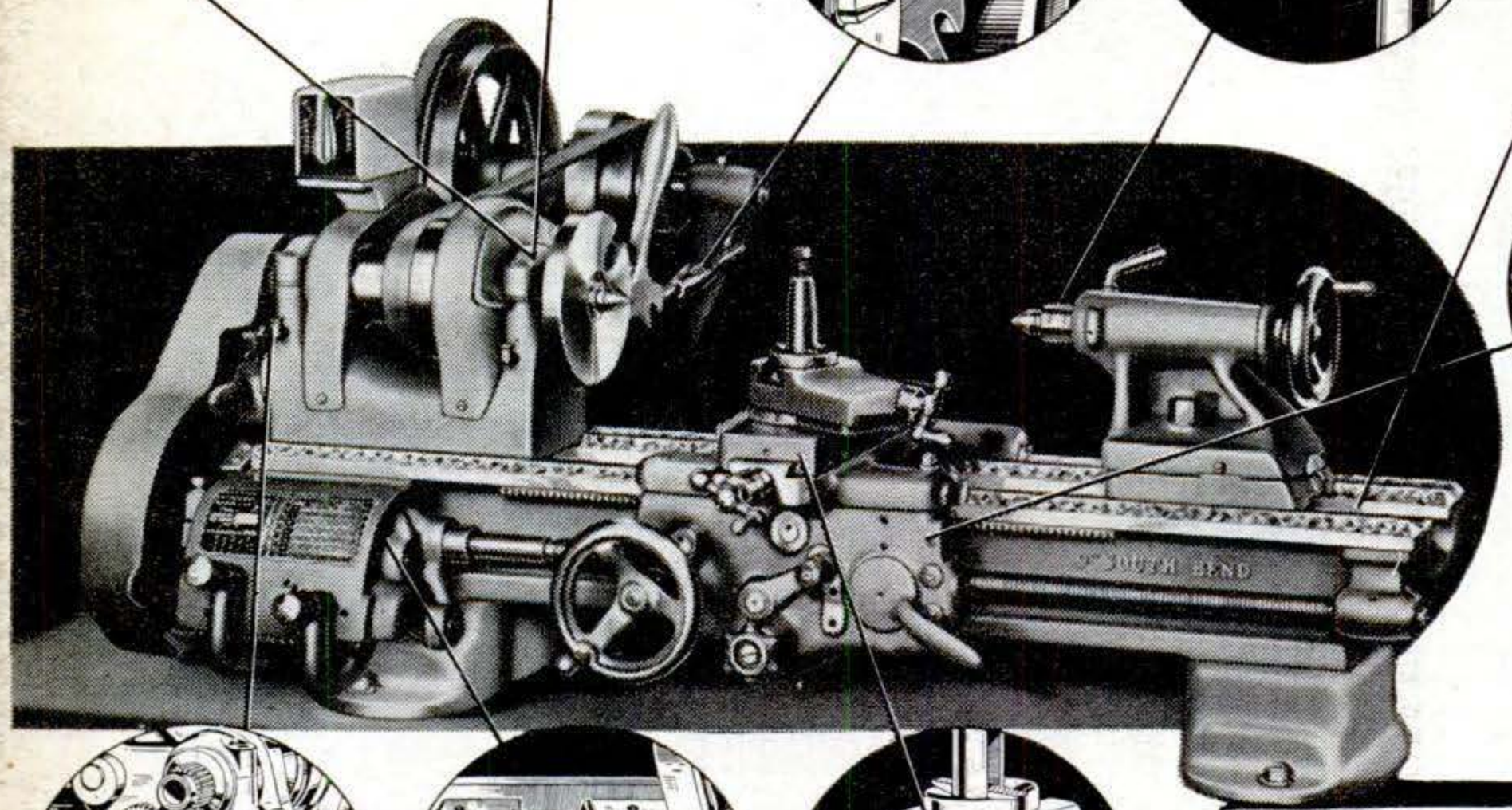
Instant release of belt tension for speed changes. Proper tension of headstock spindle drive belt is easily adjusted.

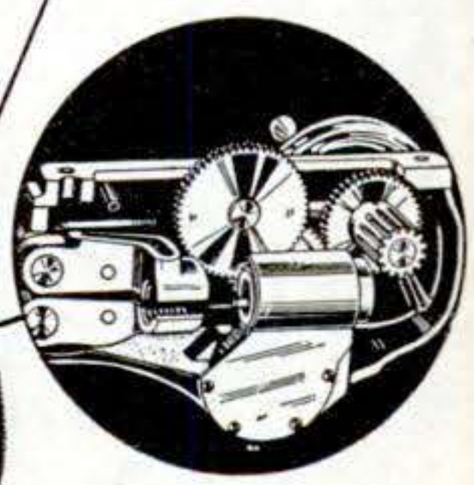
TAILSTOCK

Has set-over for taper turning. Graduated spindle has witness mark for aligning cutter bit. Hardened center self-ejecting.

BED

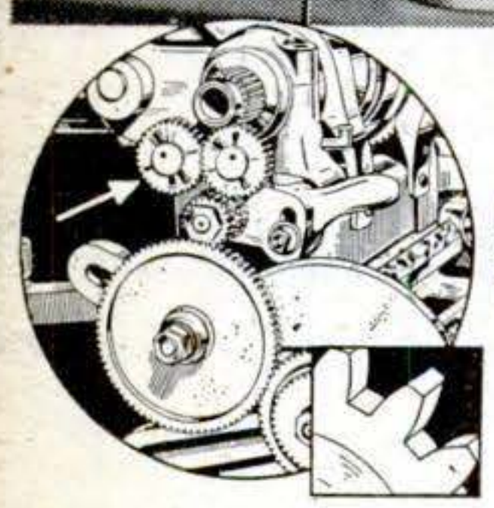
Three V-ways and one flat-way are hand-scraped entire length for precision alignment of headstock, tailstock, and carriage.





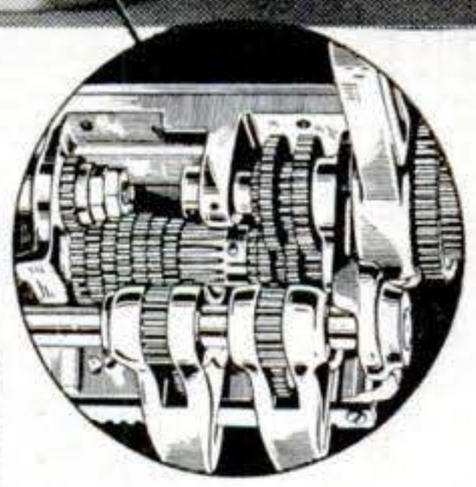
APRON

Has powerful friction clutch and large half-nuts. Safety interlock prevents engaging opposing feeds. All gears machine cut.



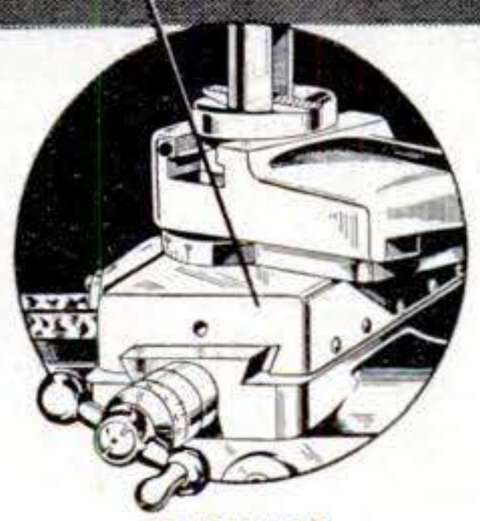
REVERSE GEARS

Easily shifted for reversing lead screw rotation and feeds, positive lock. All the gears used in this lathe are machine cut.



GEAR BOX

Screw threads and power feeds selected by shifting two tumblers as indicated on index chart. All gears machine cut steel.



CARRIAGE

V-ways and dovetails hand-scraped. Engine divided micrometer collars on feed screws. Compound Rest base graduated 180 degrees.

Specifications...

South Bend 9" Model A Lathe

SWING . . . . . over bed — 9-1/4"
over cross slide — 5"

BED LENGTHS . 3, 3-1/2, 4, and 4-1/2 feet

DISTANCE BETWEEN CENTERS . 16" to 34"

SPINDLE SPEEDS (12) . 41 to 1270 r.p.m.

POWER FEEDS:
Longitudinal (48) . . . . .0015" to .0853"
Cross-feed (48) . . . . . .0004" to .0252"

THREADS (48 pitches) . . 4 to 224 per inch

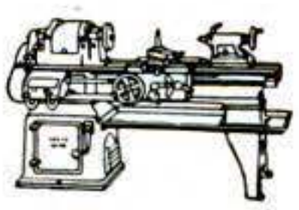
MAXIMUM COLLET CAPACITY. . . 1/2 inch

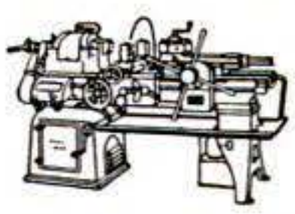
SPINDLE BORE . . . . . 3/4 inch

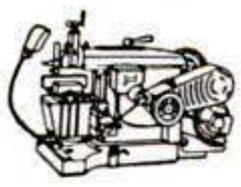
TAILSTOCK TOP SET-OVER . . . . 5/8 inch

PLEASE SEND INFORMATION CHECKED:

☐ _____







☐ TOOLS & ATTACHMENTS ☐ 10" to 16-24" FLOOR LATHES ☐ TOOL GRINDERS ☐ ½" & 1" Collet TURRET LATHES ☐ 7" BENCH SHAPERS ☐ 9" and 10" BENCH LATHES ☐ DRILL PRESSES

Name_____ Company_____

Street_____ City & State_____

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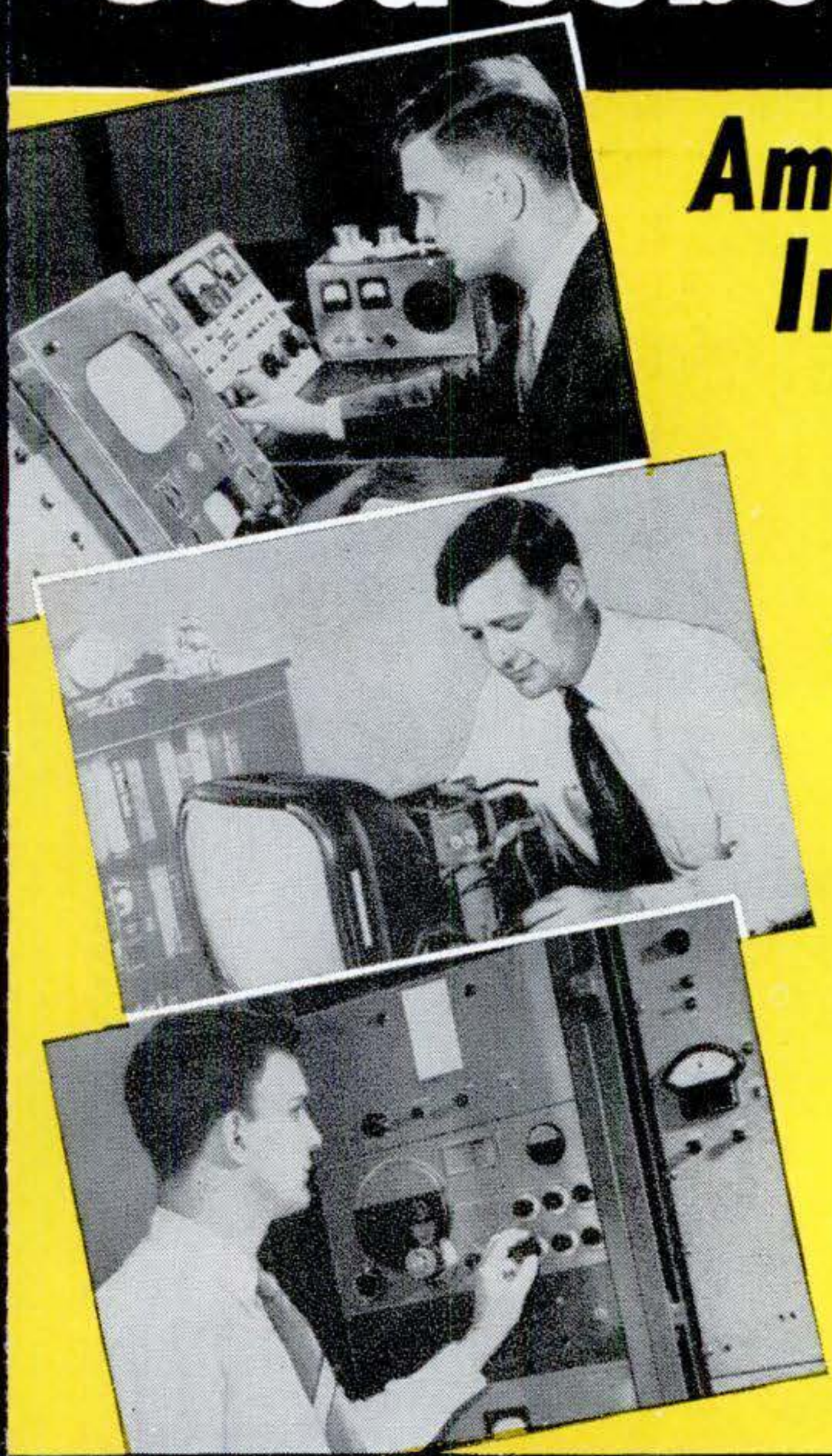
I'll Train You at HOME in Spare Time for Good Jobs in RADIO-TELEVISION



America's Fast-Growing Industry Offers You

1. EXTRA MONEY IN SPARE TIME

Keep your job while training at home. Many NRI students make $10, $15 a week extra fixing neighbors' sets in spare time, starting soon after enrolling. The day you enroll I start sending you special booklets that show you how to fix sets. You use the Multitester built with equipment I furnish to locate and correct set troubles. Adam Kramlik, Jr., Sumneytown, Pa., wrote: "Earned $12 to $15 a week, spare time. Now have my own Radio-TV shop."

2. GOOD PAY JOB

Radio-Television growth and expansion and new uses for known principles are making more jobs for well-trained men. There are over 3000 Radio Broadcasting Stations on the air giving good pay to operators, technicians. Over 115 million home and auto Radios are now in use, providing full time and spare time servicing opportunities. Government, Aviation, Police, Ship, Micro-wave Relay, Two-way Radio Communications for buses, taxis, trucks, railroads are growing fields of opportunity.

3. BRIGHT FUTURE

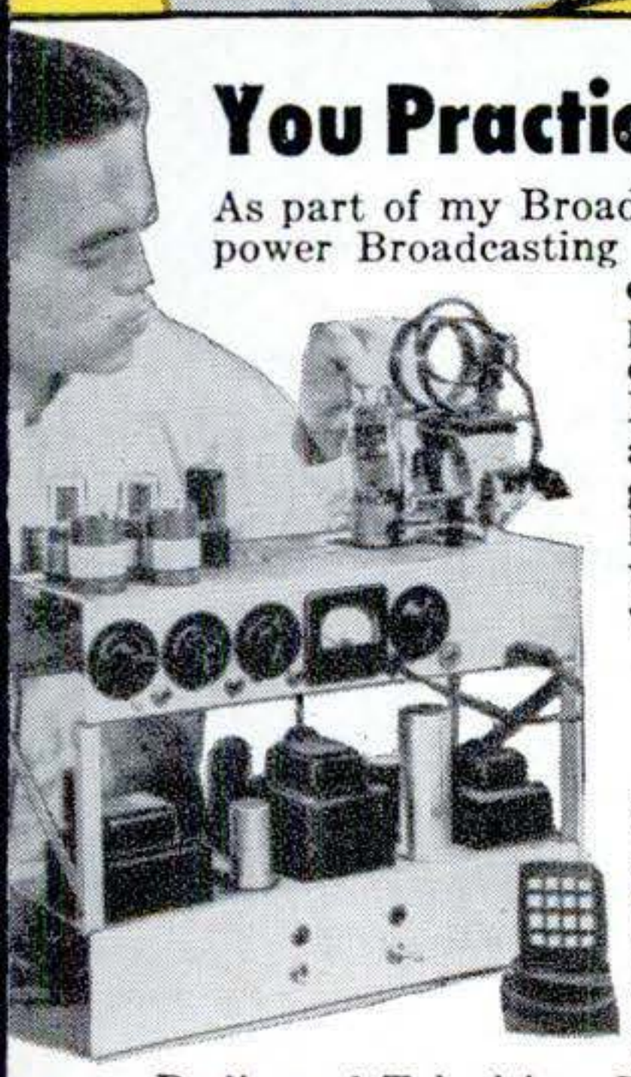
About 200 Television stations are now on the air from coast-to-coast. Hundreds more being built and hundreds of others authorized. These new stations will need operators, technicians. More than 25 million Television sets are already in use and require servicing. Thousands more Television sets are being sold every week and need installation, servicing. Act now to qualify for a good job or your own sales and service business. Cash in on this rapid growth.

Television is Making Good Jobs, Prosperity

Training plus opportunity is the PERFECT COMBINATION for job security, advancement. When times are good, the trained man makes the BETTER PAY, gets PROMOTED. When jobs are scarce, the trained man enjoys GREATER SECURITY. NRI training can help assure you and your family more of the better things of life. My training is practical, complete; is backed by 40 years of success training men at home. My well illustrated lessons give you basic principles you need and my skillfully developed kits of parts "bring to life" things you learn from the lessons.

Find Out What Radio-Television Offer You

Without obligating you in any way, I'll send an Actual Lesson to prove that training at home is practical. I'll send my 64-page book to show good job opportunities for you in Radio-Television, show equipment you build, show what my graduates are doing and earning. Terms for NRI training are as low as $5 a month. Many graduates make more in two weeks than the total cost of my training. Mail coupon now. J. E. SMITH, President, National Radio Institute. Dept. 3KB, Washington 9, D. C. OUR 40TH YEAR.



You Practice Broadcasting *with Parts I Send*

As part of my Broadcasting Course I send you kits of parts to build the low-power Broadcasting Transmitter shown at left. You use it to get practical experience putting a station "on the air," performing procedures demanded of broadcasting station operators. An FCC Commercial Operator's License can be your ticket to a better job and a bright future. My Communications Course gives you the training you need to get your license. Mail card and see in my book other valuable equipment you build.

You Practice Servicing *with Parts I Send*

Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use parts I furnish to build many circuits mon to Radio and Television. With my Servicing Course build the modern Radio shown at right. You build a Multi- r which you use to help fix sets while training. Many stu- s make $10, $15 a week extra fixing sets in spare time, ing a few months after enrolling. All equipment I send is

The Tested Way to Better Pay

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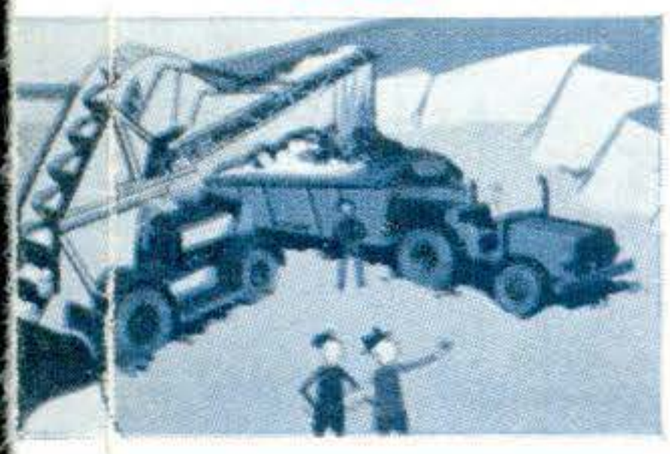
THE TOYS WITH *Important* EXTRAS

Here are two of the finest toys in the world—authorized working models of giant machines—wonderfully realistic in performance—superbly constructed to give youngsters *years of fun!*

And these toys have important *extras!* They teach youngsters basic principles of engineering—give them *practical knowledge* that can help them all through life. Above all, these Model Toys *build character*—divert a boy from harmful types of play—turn his thoughts and energies toward *constructive purpose.*

The *Model* BARBER-GREENE 3-in-1 BUCKET LOADER performs like the powerful machine that fills huge trucks on big construction jobs. "Spiral feeds" force sand or gravel into piles for loading. Chain-driven buckets bite into the piles, move up and empty onto conveyor belt which takes the loads and dumps them for other Model Toys. Front wheels steer. Loading unit raises for road clearance in travel. **Fair Trade Price* — $18.95**

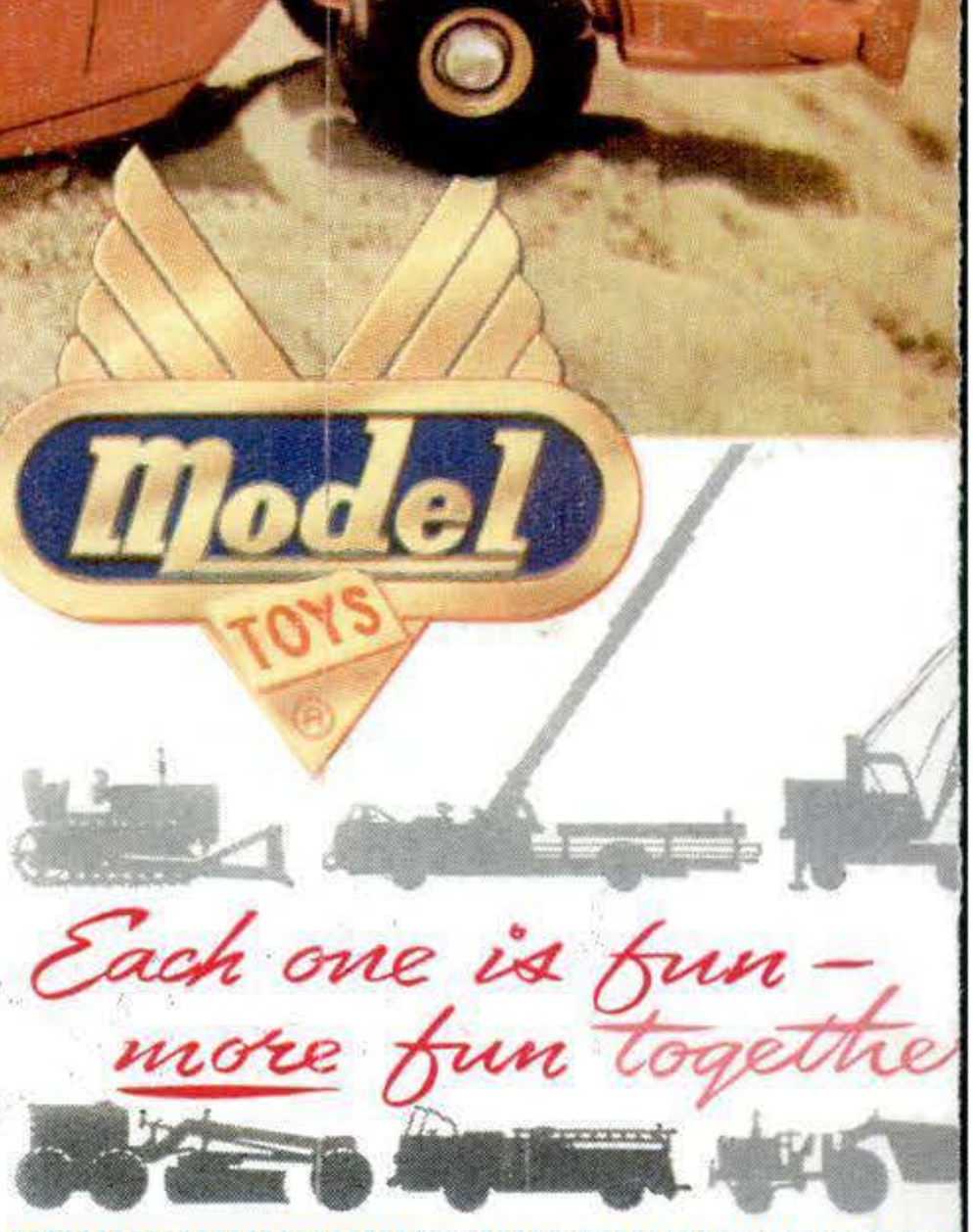


The *Model* HEILINER-SCRAPER duplicates the action of the huge, triple-duty earth mover. Scoops up earth — hauls and dumps it for other Model Toys to level or pick-up. Has universal-type coupling between tractor and trailer. All operations are mechanically controlled. **Fair Trade Price* — $15.95**

*** Prices 80c higher in 11 Western States.**

MODEL TOYS ARE CONSTRUCTED OF HEAVY-GAUGE STEEL, OUTLAST OTHER TOYS 3 TO 1!

Model TOYS



Each one is fun — more fun together

To: THE CHAS. WM. DOEPKE MFG. CO., Inc.
ROSSMOYNE 1, OHIO
Please send me your color catalog of Model Toys.

NAME _____

STREET ADDRESS
OR RURAL ROUTE _____

CITY _____ ZONE _____ STATE _____

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